



Report for

Regional Radio Systems Assessment

prepared for

Alamo Area Council of Governments

March 2011 ©

L.R. KimballSM
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1. EXECUTIVE SUMMARY

L.R. Kimball respectfully submits this Regional Radio Systems Assessment Report to the Alamo Area Council of Governments (AACOG). AACOG contracted L.R. Kimball to provide an assessment of the current public safety land mobile radio (LMR) communications systems present within the AACOG region.

The purpose of this assessment is to provide a comprehensive analysis of the current public safety radio systems utilized within AACOG, understand the current and future needs of the system users, provide recommendations for improvements to these systems, evaluate the applicable currently available and emerging technologies, make recommendations for the best technology solutions and develop migration plans for each system to implement the recommended technologies. The findings from the assessment have been used to support the development of a Regional Interoperability Communications Plan (RICP), which defines strategic goals for establishing interoperability within the AACOG region. The RICP itself includes a summary of the findings outlined in this document.

Two-way radio systems provide the critical wireless communications link between 9-1-1 dispatchers, fire/rescue, law enforcement, emergency medical responders, public works and general government personnel. Radio systems typically manage traffic for a particular agency or jurisdiction. However, larger incidents often require cross-agency communications. Technology gaps resulting from proprietary technologies, frequency band or other limiting factors that may inhibit this level of communication are defined as interoperability. Interoperability is essential to assure first responders can communicate effectively in the event of a large-scale disaster and is a major element of this assessment, and the RICP.

L.R. Kimball evaluated systems in Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina and Wilson Counties during the assessment.

In order to determine the state of radio communications and the options available to the entities, L.R. Kimball conducted a data collection process that tapped into the knowledge of local officials, Federal Communications Commission (FCC) databases and local radio vendors. As part of this effort, L.R. Kimball conducted face-to-face interviews, site visits, site inventories, phone interviews and database searches. Out of this effort, findings and recommendations, along with supporting documentation, were developed to be included as part of the final report to the agencies. Based on the presentation of findings and recommendations, technology options were selected that have been implemented into the migration plan.

The challenges associated with radio communications in the future are quite different from what they were in the past. The need to communicate effectively is an important part of AACOG agencies' ability to provide services to their citizens. The agencies recognize the importance of having properly functioning communications networks that enable the appropriate first responder disciplines to respond to any threat or challenge that may present itself, be it cross-agency, cross-discipline or cross-jurisdiction.

1.1 Summary of Findings

1.1.1 AACOG Region

The region as a whole includes many radio systems using diverse technologies and frequency bands. The region is geographically centered on Bexar County, which encompasses the city of San Antonio. Radio users within Bexar County account for the largest response force in the region, and are likely responders in the event of a major disaster anywhere within AACOG. These users predominantly utilize the shared city of San Antonio and Bexar County (COSA/Bexar County) 800 MHz Enhanced Digital Access Communication System (EDACS). Outside Bexar County, radio systems predominately operate in the Very High frequency (VHF) band using conventional radio systems. These systems employ multiple radio sites using distinct repeater frequencies to obtain wide area coverage. Some of these systems have been upgraded to operate in the Project 25 (P25) conventional mode, while other systems remain in the wideband analog mode. The region includes a number of users who are tenants on the Lower Colorado River Authority (LCRA) 900 MHz EDACS system. This system provides wide-area coverage throughout the northern half of the AACOG counties.

Interoperability within the region is limited predominantly between users on different frequency bands and technologies. Interoperability among VHF users is generally adequate utilizing shared VHF channels. TXLAW2 (intercity) and TXLAW1 (car-to-car) are prevalent in almost every system within the region. Shared channel usage is based on verbal agreements between neighboring agencies and is not documented in formal agreements or standard operating procedures (SOPs). Interoperability is virtually non-existent between VHF and 800 MHz outside of Bexar County. This limits the ability of responders from within Bexar County to communicate with VHF primary users in the event of a major disaster where users from within Bexar County would have to respond outside of the county limits. Some patching systems are in place; however, these systems are ineffective unless overlapping coverage exists in both frequency bands. Users on LCRA 900 MHz EDACS system have limited connectivity with users in both the 800 MHz and VHF bands. Because the LCRA system provides wide area coverage, effective use of patching is implemented in some areas to allow connectivity with other frequency bands. However, there are many interoperability gaps between the LCRA system and other users resulting from a lack of gateways or SOPs to govern the effective use of gateways.

To resolve interoperability concerns throughout the region, L.R. Kimball recommends that a 700 MHz P25 system be implemented that will provide a minimum of 90 percent mobile coverage throughout the entire AACOG region. The system will be built and maintained by LCRA, using approximately 19 radio systems. The system will serve as an interoperability backbone that will interconnect all radio users interfaced with the system. Local systems may either connect to the regional system using gateways or shared channels, or migrate to the regional system for primary operations. A single set of SOPs will outline use of the shared system, limiting interoperability requirements to connectivity with a single system. Inner RF-Sub System Interface (ISSI) gateways will connect the regional system with neighboring P25 systems to permit system-to-system roaming throughout the entire network of interconnected P25 systems. The regional 700 MHz network has already been installed within the AACOG region along Interstate 10 east of San Antonio. San Antonio has purchased a VIDA switch to expand 700 MHz P25 coverage within Bexar County. The LCRA VIDA switch will be connected with the COSA/Bexar County VIDA switch to allow seamless roaming between the two systems without the need of an ISSI gateway.

Estimated System Cost: \$6,150,000

1.1.2 Atascosa County

Radio communications within Atascosa County are characterized by two primary radio systems; a VHF conventional system using a single transmitter with satellite receivers utilized by the Atascosa County Sheriff's Office (SO) and county fire services, and a single-site VHF conventional system used by the city of Jourdanton. The county system operates on a P25 digital repeater for law enforcement operations and a wideband analog repeater for fire/emergency medical service (EMS) operations. Efforts are being undertaken to replace wideband fire radios to satisfy the FCC's narrowbanding mandate.

Key concerns regarding the existing radio systems within Atascosa County include radio system coverage gaps, operational challenges using a conventional architecture, radio site conditions below the industry standard for reliable communications and lack of interoperability with users outside the VHF band. To address the system limitations, L.R. Kimball recommends the county implement a three-site four-channel VHF conventional P25 simulcast system in the VHF band that will support all public safety users in the county. The system will be built out over the next five years and will leverage recent purchases of P25 equipment. The system will provide countywide coverage, have flexible capacity to accommodate all existing users, and will support expansion to trunking operations at a later date, should the need be great enough. L.R. Kimball recommends that Atascosa County explore migration to the regional 700 MHz P25 trunking system once the system has been expanded within Atascosa County.

Estimated System Cost: \$2,720,000

1.1.3 Bandera County

Radio communications within Bandera County are characterized by one primary radio system, which includes two VHF repeaters used by the SO and multiple VHF repeaters used by individual fire and EMS agencies. The SO has upgraded radios to P25 conventional operation to satisfy the narrowbanding mandate. Fire radios and repeaters are mixed wideband and narrowband, with efforts currently being undertaken to replace aging wideband-only equipment.

Key concerns regarding the existing radio system within Bandera County include operation challenges using a conventional architecture, spread resources across multiple radio sites that provide near equivalent coverage, use of mixed P25 and analog technologies, radio site conditions below the industry standard, and lack of interoperability with users in different frequency bands.

To address the system limitations, L.R. Kimball recommends the county implement a five-site five-channel conventional P25 simulcast system in the VHF band that will support all public safety users in the county. The system will be built out over the next five years and will leverage recent purchases of P25 equipment. The system will provide countywide coverage, have flexible capacity to accommodate all existing users and will support expansion to trunking operations at a later date, should the need be great enough. In the long-term, L.R. Kimball recommends that Bandera County explore migration to the regional system.

Estimated System Cost: \$3,850,000

1.1.4 Bexar County

Radio communications within Bexar County are characterized predominantly by the COSA/Bexar County 800 MHz EDACS system. The system utilizes 12 sites with mixed simulcast and multi-cast technologies. Approximately 120 frequencies are used in the system. The system was accepted in 2004, meeting criteria for 95 percent in-building coverage throughout the county, with stricter coverage required within the San Antonio city center. The system is jointly owned by the city of San Antonio and Bexar County. In addition to the system owners, most local government agencies operate as tenants on the system, paying a subscriber fee to cover system maintenance costs. Dispatch for each agency on the system is disparate, with most agencies maintaining their own public safety answering point (PSAP) and dispatch operations. Plans are in place to implement a 700 MHz P25 overlay on the system to cover the center of the county. A VHF overlay is planned to enhance interoperability with VHF users within Bexar County. The city of Live Oak maintains a single site EDACS 800 MHz system that provides primary service for five municipalities located in the border area between Bexar and Guadalupe Counties.

Other radio systems within Bexar County operate predominantly in the VHF band. A single site VHF simplex system, referred to as the Bexar County Fire Alarm system, serves as the primary radio system for approximately 21 volunteer fire departments (VFDs) within Bexar County. Several municipalities operate primarily in the VHF band, but are in the process of migrating to the COSA/Bexar County system. Other VHF primary agencies have no plans to migrate to the COSA/Bexar County system.

Key concerns regarding the existing radio systems within Bexar County include interoperability between 800 MHz and VHF users, funding limitations to upgrade subscriber radios and infrastructure on the COSA/Bexar County system to P25, coverage limitations in the northern portions of the county, fragmented dispatch operations, limited console capabilities on tenant agencies, narrowbanding for users on the Fire Alarm system and use of non-public safety-grade radios among VHF primary systems.

To address these issues, L.R. Kimball recommends that all users within Bexar County migrate primary operations to the COSA/Bexar County system. Migration will be accomplished over time to allow the staged replacement of subscriber radios. The agencies migrating include Leon Valley and users on the Bexar County Fire Alarm system. Upgrade of the COSA/Bexar County system to P25 will take place over the next five years as aging subscribers are replaced with P25 capable subscribers. Funding for the replacement of fixed infrastructure will be targeted during 2014 as the EDACS system reaches ten years in age. L.R. Kimball recommends that upgrades be made to dispatch consoles to permit greater functionality and channel capacity at local PSAPs. The predominant expense for users within Bexar County is the upgrade of the EDACS system to P25. Over 10,000 P25 subscribers with trunking capabilities will need to be purchased in addition to the fixed infrastructure. The upgrade includes the addition of three radio sites to provide enhanced coverage. The city of San Antonio has received a 700 MHz waiver and plans to build out a long-term evolution (LTE) broadband system. Upfront costs for the LTE system have been included in the estimated cost.

Estimated Cost: \$95,740,000

1.1.5 Comal County

Radio communications within Comal County are characterized predominantly by the county system covering county SO and fire operations, and the LCRA EDACS system covering operation for the city of New Braunfels. The county

system utilizes multiple VHF conventional repeaters with satellite receivers. The law enforcement portion of the system utilizes two primary channels at separate locations. The fire portion of the system uses a primary dispatch channel with agency-operated simplex and repeater systems utilized for tactical operations.

Key concerns regarding users on the county system include interoperability with out-of-band users, operational challenges associated with using a conventional architecture, and coverage gaps on the fire system. Key concerns with the New Braunfels system include the pending decommissioning of the EDACS system and limited interoperability between New Braunfels and the county.

To address these concerns, L.R. Kimball recommends that Comal County implement a three-site six-channel VHF P25 simulcast system. This system will provide seamless roaming throughout the county without requiring users to change channels. The system will provide increased coverage and capacity sufficient to support the SO and all county fire operations. Cost savings will be recognized by reusing existing subscriber and backhaul equipment and by connecting to a shared P25 switch. Migration will require further development of radio sites, replacement of analog subscriber radios and installation of simulcast site equipment.

New Braunfels will migrate primary operations to the P25 regional 700 MHz system using the LCRA backbone. This upgrade will require the replacement of all New Braunfels subscriber radios. Interoperability will be enhanced by connecting the Comal County system to the regional P25 system through gateways. Permanent patches will be established linking New Braunfels talk groups with Comal County talk groups.

Estimated Cost: \$2,358,000

1.1.6 Frio County

Radio communications within Frio County are characterized by two VHF analog repeaters located at a single site in the center of the county. A single channel is used for dispatch and tactical operations for all law enforcement within the county and a second channel is used by all fire and EMS services. Subscriber radios belonging to the SO have been upgraded to P25 capable radios. The remaining subscriber radios are a mix of narrowband and wideband. Base stations are not narrowband-compliant.

Key concerns regarding the Frio County radio system include insufficient system coverage, radio sites below industry standards for reliable communications, use of equipment that is largely not narrowband-compliant and insufficient channel capacity.

To address these concerns, L.R. Kimball recommends that Frio County upgrade its current system to a P25 conventional system. Radio site enhancements will be made to upgrade existing tower locations. The system will provide a reliable network that will provide countywide coverage, increased capacity and increased interoperability with the rest of the region. Upgrade to the system will require the replacement of most subscriber radios because only the SO radios are capable of P25 operation. In the long-term, L.R. Kimball recommends that Frio County migrate to the regional 700 MHz P25 system.

Estimated Cost: \$1,365,000

1.1.7 Gillespie County

Radio communications within Gillespie County are characterized by two primary radio systems; a VHF conventional system used by fire and EMS services, and the LCRA 900 MHz EDACS system used by all law enforcement. The VHF system operates from three radio sites covering the central, western and eastern portions of the county. The channels are used for dispatch and tactical operations. Several VFDs maintain their own VHF base stations, which are used for tactical communications.

Key concerns with users on the Gillespie County fire/EMS system include insufficient system coverage throughout large portions of the county, operational challenges with a conventional architecture and interoperability with out-of-band users, including local law enforcement on the 900 MHz LCRA system. To address these concerns, L.R. Kimball recommends that all public safety users within Gillespie County migrate to the P25 regional 700 MHz system. This migration will permit P25 operation by all county users, creating seamless interoperability between all county users and between users in neighboring systems. The system will provide seamless roaming throughout the county, with capacity to accommodate all public safety users. The upgrade will require the replacement of all subscriber radios within Gillespie County.

Estimated Cost: \$1,580,000

1.1.8 Guadalupe County

Radio systems within Guadalupe County are characterized by four primary radio systems; a VHF conventional analog system providing service for the SO and County Fire, a VHF conventional mixed mode system for the city of Seguin PD and fire department (FD), a conventional VHF analog system for the city of Cibolo PD and FD, and the Live Oak 800 MHz EDACS system providing service for Schertz and Selma. The county SO and fire system includes a network of three conventional VHF repeaters with satellite receivers. Subscriber radios and base stations are narrowband capable, but will not support P25 operation. The cities of Seguin and Cibolo each utilize single-site conventional systems with separate channels for police and fire. These systems operate in the analog mode. The Live Oak system is a single-site 800 MHz EDACS. Subscriber radios on this system are predominantly not P25 capable.

Key concerns regarding radio systems in Guadalupe County include operational challenges with the extensive use of conventional architectures, predominant use of radios below public safety grade, coverage gaps in the county system and localized interoperability gaps resulting from different technologies, frequency bands, and lack of SOPs.

Guadalupe County has indicated plans to build out a Kenwood NEXEDGE solution for countywide communication. While L.R. Kimball does not favor implementation of a proprietary business solution for public safety use, L.R. Kimball recommends that Guadalupe County take steps with the system implementation to assure connectivity with the regional P25 700 MHz system. The system will provide increased capacity through the use of time division multiple access (TDMA), which can be used to support data features such as automatic vehicle location (AVL). L.R. Kimball notes that NEXEDGE subscriber radios will not operate on P25 systems, and do not currently have an upgrade path to P25. Radios from any other jurisdiction will not be able to communicate on the NEXEDGE system. A network on conventional VHF channels will be needed to ensure interoperability with neighboring VHF jurisdictions.

L.R. Kimball recommends that Cibolo migrate to the COSA/Bexar County 800 MHz trunked system once the system incorporates the Live Oak system and expands coverage in the Cibolo area. In the interim, Cibolo will purchase multi-band radios to operate on the existing VHF system until the 800 MHz system is expanded. L.R. Kimball recommends the city of Seguin implement a single-site trunking system tying into an existing P25 regional system core.

Estimated Cost: \$1,062,900 (excluding Guadalupe County NEXEDGE upgrade)

1.1.9 Karnes County

Radio communications within Karnes County are characterized by a single conventional repeater channel with satellite receivers shared by all SO, fire and EMS disciplines. A separate simplex base station is used by Karnes City for police dispatch. Subscriber radios within the county are exclusively analog, with many not compliant with narrowband operation.

Key concerns regarding the Karnes County radio systems include insufficient coverage, poor reliability resulting from a single point of failure, insufficient capacity to accommodate all public safety users and lack of interoperability with out-of-band users.

L.R. Kimball recommends that Karnes County implement a three-site, five-channel VHF P25 conventional simulcast system. The system will provide countywide coverage with seamless user roaming between radio sites. Analog-only subscribers will need to be replaced with P25 capable subscribers by all first responders within the county. In the long-term, L.R. Kimball recommends that Karnes County consider migration to the 700 MHz regional system.

Estimated Cost: \$1,347,000

1.1.10 Kendall County

Radio communications within Kendall County are characterized by two primary radio systems; a single-site VHF system used for county fire services and LCRA 900 MHz EDACS system used by all county law enforcement agencies. The fire/EMS system includes three primary channels covering fire dispatch, fire tactical operations and EMS dispatch. Individual VFDs operate their own base stations for tactical communications.

Key concerns regarding the Kendall County fire system include limited capacity to support multiple incidents, coverage gaps in portions of the county, interoperability gaps and extensive use of wideband analog radios. Key concerns regarding the law enforcement system include the pending decommissioning of the EDACS system.

Kendall County has been awarded grant funding to replace their radio system and is currently deciding on a migration path to either the 700 MHz regional system or a Kenwood NEXEDGE system. L.R. Kimball recommends that Kendall County utilize the funding to migrate all users within the county to the P25 700 MHz overlay. The system will provide enhanced coverage throughout the county and scalable capacity to meet the needs of all users. The system will support P25 Phase II prior to 2017, which includes TDMA. The technology supports the ability to implement low-speed data applications such as AVL; however, upgrades may be needed on the LCRA network to accommodate these features. The 700 MHz upgrade will require the replacement of all subscriber radios within Kendall County, including fire/EMS and law enforcement.

Estimated Cost: \$1,777,500

1.1.11 Kerr County

Radio communications within Kerr County are characterized by four primary radio systems; the Kerr County SO system utilizing four-site two channel VHF conventional simulcast, the Kerr County fire system utilizing VHF conventional repeaters at two radio sites, the Kerrville FD system utilizing a three-site VHF conventional system and the Kerrville Police Department (PD) system utilizing a single-site with three mixed mode repeaters. Subscriber radios on the law enforcement systems have predominantly been upgraded to P25. Subscriber radios on the county fire system are predominantly analog-only with some wideband-only radios.

Key concerns regarding the Kerr County radio systems include split resources between systems and radio sites, which provide near equivalent coverage; capacity for individual departments; and interoperability with out-of-band users.

To address these concerns, L.R. Kimball recommends that Kerr County migrate to the regional 700 MHz system. The number of users on the system justifies trunking operation. Build out of a VHF trunking system will be more expensive compared to 700 MHz options because the cost for the 700 MHz infrastructure will be covered by the regional system. The system will provide P25 operation with increased coverage and capacity compared to the existing systems. The system will provide a clear upgrade path for Kerr County VFDs, which are still operating in the analog mode.

Estimated Cost: \$2,715,000

1.1.12 Medina County

Radio communications within Medina County are characterized by two primary radio systems; a single-site two-channel VHF conventional system used by the Medina County SO and fire services, and a single-site single-channel police system used by the city of Hondo. Several FDs maintain their own base stations for tactical communications, including Castroville, Devine, and Natalia.

Medina County has indicated plans to build out a countywide VHF P25 trunking system for all public safety users within the county. The system will utilize a shared P25 switch.

Estimated Cost: \$3,485,000

1.1.13 Wilson County

Radio communications within Wilson County are characterized by two primary radio systems: a P25 conventional system with satellite receivers used by law enforcement agencies, and an analog conventional system utilizing one primary frequency at multiple radio sites. Continuous Tone Coded Squelch System (CTCSS) tones are used to isolate traffic on the analog system.

Key concerns regarding the Wilson County radio system include insufficient system coverage, capacity to support multiple incidents, use of wideband analog non-P25 radios among VFDs, and interoperability with out-of-band users.

To address these concerns, L.R. Kimball recommends that all public safety users within Wilson County migrate to a three-site, four-channel VHF P25 conventional simulcast system. The system will provide countywide coverage, increased capacity, improved interoperability, reliable system infrastructure and P25 operation. Upgrading to the system will require the replacement of non-P25 radios within Wilson County. In the long-term, L.R. Kimball recommends that Wilson County explore upgrade options for the 700 MHz regional system.

Estimated Cost: \$2,650,000

1.2 Funding Summary

One goal of the RICP is to identify the estimated cost associated with building out the recommended systems, compare that cost to the amount of funding available, and identify the difference needed to build out the recommended systems. Table 1 summarizes costs for all recommended radio projects. Estimated costs include system build out and cost of ownership over the ten year period between 2011 and 2020.

Table 1 – Funding Summary

System	Interoperability Spending over Last Four Years	Projected Funding Over Next Ten Years	Funding Required to Meet Interoperability Goals	Additional Funding Required
Region	\$1,000,000	TBD	\$6,360,000	\$6,360,000
Atascosa	\$258,000	\$0	\$2,964,000	\$2,964,000
Bandera	\$134,794	\$115,000	\$4,156,250	\$4,041,250
Bexar	\$533,400	\$1,243,000	\$96,094,600	\$94,851,600
Comal	\$1,014,618	\$1,940,423	\$4,475,020	\$2,534,597
Frio	\$115,000	\$2,000,000	\$1,410,000	\$0
Gillespie	\$53,275	\$100,000	\$1,990,400	\$1,890,400
Guadalupe	\$846,531	\$155,000	\$1,306,920	\$1,151,920
Karnes	\$194,000	\$0	\$1,449,000	\$1,449,000
Kendall	\$23,352	\$557,932	\$2,292,658	\$1,734,726
Kerr	\$859,510	\$758,000	\$3,553,600	\$2,795,600
Medina	Not Provided	Not Provided	\$3,966,500	\$3,966,500
Wilson	\$143,200	\$0	\$2,803,000	\$2,803,000
Total	\$5,175,680	\$6,869,355	\$132,821,948	\$126,542,593

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2. INTRODUCTION

AACOG is a regional body of government within the state of Texas that encompasses the counties of Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina and Wilson.

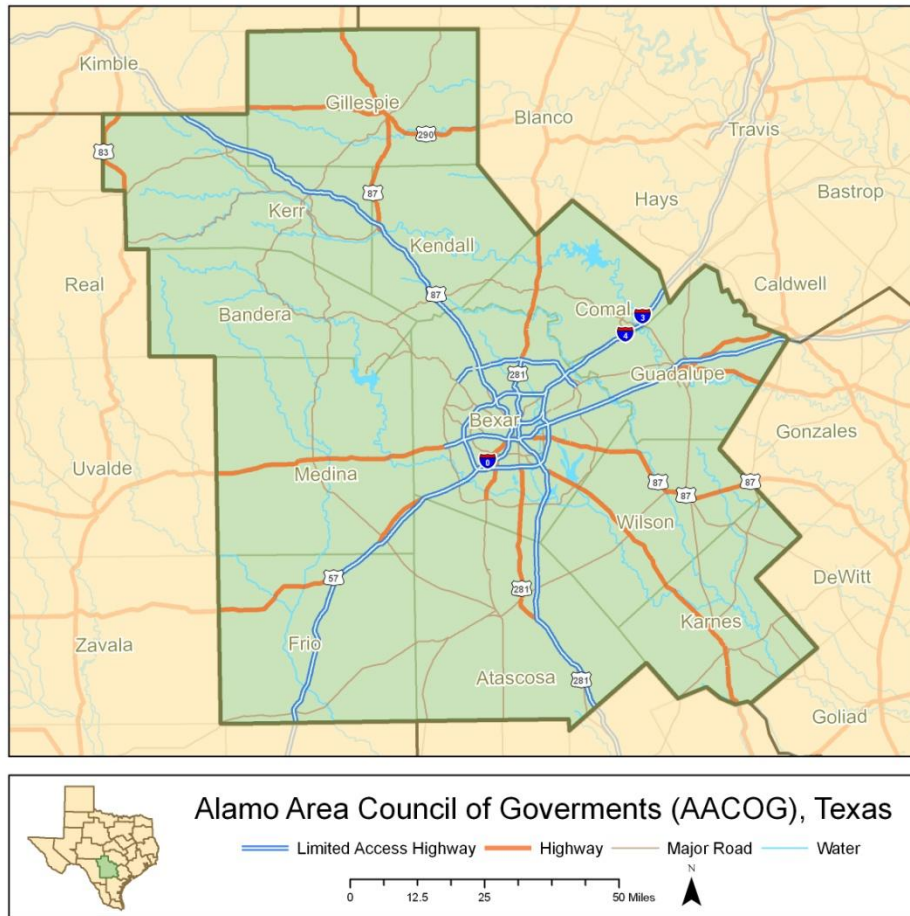


Figure 1 – AACOG Region

L.R. Kimball was contracted to perform a regional radio system assessment of all systems within AACOG. The assessment includes an analysis of the existing systems, operability and interoperability gap analysis, recommendations for each system, and a migration strategy to implement the recommended systems. The purpose of the study is to support the AACOG RICP, which will define a path for the COG to develop a P25 “system-of-systems” by the year 2015.

3. METHODOLOGY

3.1 Initialization Meeting

On June 16, 2010, a project initialization (kickoff) meeting was held with AACOG member agency representatives, AACOG personnel and L.R. Kimball project team representatives.

The key elements of the RICP were discussed, with a focus on the need to document gaps in interoperability, identify technology solutions to bridge those gaps, and develop a migration plan to implement the selected technologies. The project objective and schedule was defined. Primary users and stakeholders were identified and contact information was exchanged.

Following a project extension and modification in the RICP scope from the Texas Department of Public Safety (TXDPS), a second kickoff meeting was held on August 5, 2010. During this meeting, changes in the scope were identified, which primarily included the development of a comprehensive needs assessment report that will define radio system needs and expenditures for each public safety agency within AACOG. A schedule was defined for on-site interviews with AACOG member agency personnel from August 16 to September 3, 2010.

A revised list of deliverables was confirmed by L.R. Kimball and the project stakeholders. The project deliverables include the following:

- Needs assessment report addressing the needs of all AACOG member agencies, complete with technology recommendations and a migration plan with year-by-year cost estimates.
- Revised RICP, complete with the conclusions identified in the needs assessment report

3.2 User Interviews

To determine user perceptions and facilitate the involvement of the public safety community and other users in the process, L.R. Kimball and AACOG organized focus groups to collect data from the radio user community. L.R. Kimball created a survey to explain the purpose of the meeting and initiate the data gathering process.

Questions and discussion topics were designed to identify key operational and performance needs of the user community and to determine how well the current systems meet these needs. Conversely, L.R. Kimball sought input of user needs that the current systems do not adequately meet, whether performance or operational in nature.

A majority of the agencies were able to attend the meetings. The users in attendance provided insightful and valuable feedback for use in planning the future public safety radio network in AACOG.

User interviews were held with representatives of the following entities/public safety agencies:

Table 2 – Interviews

County Interviews		
Atascosa County		
Atascosa County Sheriff's Office	Atascosa County Fire Services	
Bandera County		
Bandera County Law Enforcement	Bandera County Fire/EMS	
Bexar County		
San Antonio	Bexar County	Bexar County Fire Alarm
Alamo Heights, City of	Balcones Heights, City of	Castle Hills, City of
Cibolo, City of	Converse, City of	Universal City, City of
Helotes, City of	Live Oak, City of	Windcrest, City of
Leon Valley, City of	Kirby, City of	Selma, City of
Hollywood Park, Town of		
Comal County		
Comal County	Bulverde VFD	Garden Ridge VFD
New Braunfels, City of	Bracken VFD	Canyon Lake VFD
Frio County		
Frio County SO	Frio County Fire	Dilley PD
Pearsall PD		
Gillespie County		
Gillespie County Law Enforcement	Gillespie County Fire/EMS	Fredericksburg, City of
Guadalupe County		
Guadalupe County	Cibolo, City of	Schertz, City of
Seguin, City of		
Karnes County		
Karnes County		
Kendall County		
Kendall County Fire/EMS	Kendall County Law Enforcement	
Kerr County		
Kerr County SO	Ingram, City of	Kerrville, City of
Kerr County VFDs		
Medina County		
No agencies interviewed		
Wilson County		
Wilson County Law Enforcement	Wilson County Fire/EMS	

The purpose of these interviews was to:

- Collect information regarding the existing radio communications systems
- Document any known deficiencies with the existing systems, such as coverage or capacity
- Identify future communications needs
- Identify past, present and future funding streams for radio-related expenditures
- Identify interoperability needs and existing shortfalls

3.3 Assessment of Existing Systems Network Infrastructure

While on-site from August 16 to September 3, 2010, L.R. Kimball representatives surveyed system network infrastructure of AACOG member agency radio systems, including radio sites and dispatch facilities.

The purpose of these surveys was to:

- Become familiar with the existing systems
- Gather technical data regarding the existing systems to determine if equipment should be upgraded or replaced
- Determine the suitability of these sites to accommodate additional equipment that may be added to expand or replace the existing systems
- Determine if tower space is available to accommodate additional antennas
- Review the general condition of these sites

3.4 Interoperability Solutions

L.R. Kimball addressed user requirements for interoperability gathered during the project kickoff meeting and user interviews. Additional information regarding the interoperability capabilities of the entities was assessed based on the equipment surveyed during the site surveys.

Based on the data gathered, L.R. Kimball developed interoperability solutions consistent with user needs, SAFECOM recommendations, the State's Communications Interoperability Plan (SCIP), RICP objectives and guidance from the TXDPS.

3.5 FCC License Review

L.R. Kimball downloaded all FCC licenses for AACOG member agencies from the FCC's database, including tower registrations where applicable. A thorough review of these licenses was conducted on a site-by-site basis. The review was used to determine emission designator compliance with the FCC's narrowbanding mandate, assess radio site locations and operational parameters and compare licensed specifications with on-the-ground data for accuracy. Based on the analysis, L.R. Kimball completed recommendations for FCC license updates.

3.6 Coverage Studies

Computer-generated propagation studies were performed for the existing AACOG radio systems. These propagation maps were used to identify coverage gaps present in the existing radio systems and compare user input on radio

system coverage with modeled results. Additional studies were performed to evaluate coverage for conceptual system designs for future radio systems recommended for implementation.

3.7 Assessment and Survey Data Analysis

Based on the data collected during the user interviews and site surveys, L.R. Kimball provided an in-depth analysis consistent with industry standards for the various aspects of radio systems. The analysis focused on key issues, including the following:

- Coverage
- Capacity
- Interoperability needs/standards
- Emerging communication technologies
- FCC VHF/Ultra High frequency (UHF) narrowbanding mandate
- Frequency bands
- Connectivity
- Technology options

3.8 Recommendations

Based on the assessment of the AACOG member agency systems consistent with industry standards and the needs of the users, L.R. Kimball developed recommendations for system improvements, upgrades and replacements. These recommendations include budgetary pricing gathered from equipment vendor list prices and modeled coverage where changes in system tower sites/equipment are proposed. The recommendations were determined based on the system option available to each agency that best meets the needs of the users while limiting extraneous costs.

3.9 Migration Strategy

Following approval from the stakeholders on selected technologies, L.R. Kimball developed a migration strategy unique to each agency that defines a step-by-step process to implement the proposed system upgrades and replacements. Each migration strategy is complete with budgetary estimates for each phase of the implementation. The migration strategies are intended to provide a roadmap for implementation that will provide each agency a reasonable and beneficial strategy for implementing the systems selected by the users.

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4. REGIONAL FINDINGS

Radio communications in the AACOG region are characterized by communications in three primary frequency bands; VHF High band, 800 MHz and 900 MHz.

4.1 VHF Radio Systems

Throughout the AACOG region, with the exception of Bexar County, radio communications remain primarily in the VHF frequency band. These systems utilize remote conventional repeaters with control stations for console access. Coverage is enhanced through the use of multiple radio sites on different frequencies. With these systems, users must switch radio channels to access different radio sites, and dispatchers must monitor multiple channels. Several VHF agencies operate conventional simulcast or voted receiver systems using microwave backhaul. Coverage on these systems is generally adequate for mobile units, but drops off in areas for portable units. VHF users in the region are in the process of upgrading equipment to meet the FCC narrowbanding deadline of January 1, 2013. Radio equipment was estimated within the region to be 70 percent narrowbanding capable, although less than 10 percent of channels have been reprogrammed in the narrowband mode. Plans are underway within the region to meet the FCC's narrowbanding deadline. VFDs in each county utilize the most antiquated radio equipment in the region. Meeting the narrowbanding requirement will be the most difficult for these agencies, which still operate a preponderance of the remaining non-compliant equipment.

VHF systems operate in a mix of analog wideband, analog narrowband and digital P25 modes. Interoperability is addressed on these systems using shared VHF channels. VHF radios are typically programmed with the channels of adjacent jurisdictions. When users respond into the jurisdiction of a neighboring agency, users will utilize the home dispatch channel of the incident. Alternatively, mutual aid channels such as TXLAW2 and TXFIRE1 may be used for incident response in an analog mode when the technology of the home system is not compatible with incoming radios. Some degree of interoperability channels are programmed in most radios throughout the region. However, all interoperability channels including the VCALL and VTAC channels are programmed in a minority of radios within the region. Interoperability between VHF users and 800 MHz or 900 MHz users is limited throughout most of the region and is limited to a select few agencies who maintain cross-band gateways. While mobile gateways are available throughout the region, these systems are timely to deploy and are not often utilized.

There are several primary limitations associated with VHF conventional systems.

Site-to-site Roaming—In a conventional system, coverage is enhanced through the implementation of multiple repeater sites. Because each site operates as its own independent system and has no connectivity to other radio sites, traffic at each site is independent. This means that users must switch channels as they roam between coverage areas of different radio sites. Switching channels for a radio end user may be cumbersome, especially during an event when a responder's focus is elsewhere. Users within the coverage areas of different radio towers lack the ability to communicate directly with each other unless audio is patched by the dispatch console operator. Operation on a conventional system is also challenging for dispatchers who have multiple channels for each radio site. If multiple radio sites are needed to cover the jurisdiction, dispatchers must utilize simulselect features to assure all intended radio users receive the message.

Narrowbanding—Narrowbanding is the FCC mandate that requires all VHF and UHF radio systems to migrate to 12.5 kHz spectrum efficiency by January 1, 2013. To comply with this mandate, VHF primary users must replace aged equipment that is not compatible in a narrowband mode and reprogram radios operating in a wideband mode. Considerable efforts have already taken place within the region to meet the narrowbanding requirement; however, considerable efforts still remain to replace the remaining wideband only radios, reprogram radios that are narrowband capable, and update FCC licenses.

Interference—The VHF band is far more crowded with co-channel and adjacent-channel users than any other public safety frequency band, increasing the likelihood that user-to-user interference may occur. The problem is compounded by the extreme distances VHF signals may carry. CTCSS tones are typically used to limit users from hearing the transmissions of neighboring systems; however, interference will still occur when two systems attempt to transmit simultaneously.

Coverage—Much of the AACOG region covers rural areas with small population densities. Covering large areas requires multiple radio sites; however, many less populated counties with VHF systems are limited to one radio site. Coverage in many of these counties is limited to mobile use as portable coverage is restricted.

Interoperability—Interoperability for VHF primary users is limited with users in other frequency bands. The population center for the AACOG region is San Antonio, which utilizes an 800 MHz trunked system. Should a disaster occur in the rural areas of AACOG, it is likely users from Waco with 800 MHz radios will respond. Little to no capability exists throughout much of AACOG to interconnect with 800 MHz systems. While VHF-to-VHF interoperability is generally adequate for most counties, careful consideration must be made for systems operating in P25 modes. Users with analog radios, including narrowband radios, will not be able to communicate on P25 conventional channels. Conventional talkaround channels such as TXLAW1 or TXLAW2 must be used as a common conventional medium in these circumstances.

P25 Upgrades—Many VHF primary users in the region have either upgraded to P25 conventional systems or are in the process of upgrading their systems. When upgrading to P25, users must be cognizant that coverage on the system will change, and interoperability will become more limited with non-P25 VHF users.

4.2 800 MHz Systems

L.R. Kimball found that 800 MHz radio systems are used exclusively in the AACOG region within Bexar County. The largest 800 MHz system within Bexar County is the COSA/Bexar County shared 800 MHz EDACS system, which supports most local government agencies within Bexar County. A second 800 MHz EDACS system is used on the border between Bexar and Guadalupe County by Live Oak and several other surrounding agencies. Throughout the remainder of the AACOG, there are no effective systems in place today to establish interoperability with incoming 800 MHz radios. The Raytheon wide-area information server (WAIS) solution may bridge this gap, but is limited in coverage and implemented in a way that is not conducive for daily operation.

There are several primary limitations associated with 800 MHz trunking systems.

Rebanding—Rebanding is the FCC-mandated reconfiguration of the 800 MHz band to eliminate interference caused by public safety users by Sprint/Nextel iDEN networks. The reconfiguration requires users in the 866-869 MHz

NPSPAC band to relocate their channels 15 MHz to the 851-854 MHz range. The reconfiguration requires replacement of radios that do not support both the old and new frequencies, and requires re-programming subscriber radios. Throughout the effort, careful coordination is necessary to assure continuity of operations and interoperability.

Proprietary Technologies—Many of the last generation “legacy” trunking systems employ technologies that are proprietary to the equipment vendor. Only subscriber radios manufactured by the same vendor and programmed with the appropriate talk groups can communicate on a proprietary system. The use of proprietary technologies limits interoperability with other users in the same frequency band who have subscriber radios manufactured by a different vendor.

Legacy System End-of-life—Legacy systems refer to the last generation of non-P25 radio systems. Legacy trunking systems are in the process of being phased out by the equipment vendors in lieu of modern P25 technologies. The phase-out of legacy systems will ultimately result in a lack of vendor support and a short supply of spare equipment parts. Radio users must account for the end-of-life of their system and equipment and prepare for upgrades to avoid a lapse in service availability.

700 MHz—Radios in the 800 MHz band can typically access 700 MHz frequencies. The 700 MHz band was recently released to public safety and can be used to enhance capacity on trunking systems when additional 800 MHz frequencies are unavailable or to build out new trunking systems. However, 700 MHz channels have a 6.25 kHz spectrum efficiency requirement by January 1, 2017. This requirement can only be met through the implementation of TDMA technology, which will only be provided on a P25 platform by P25 Phase II. While the Phase II standard is not yet developed, some equipment vendors have products on the market that will be upgradeable to Phase II once the standard is complete.

Interoperability—Interoperability on 800 MHz networks is limited with users in the VHF and UHF frequency bands. When responding to VHF primary jurisdictions, 800 MHz users will have no means to communicate unless a gateway system or multi-band radios are implemented. A mobile gateway may be deployed to provide the necessary interoperability; however, deploying mobile gateways is a cumbersome and time-consuming process. Communications within the primary jurisdiction of 800 MHz systems can be provided through conventional interfaces to VHF channels, typically TXLAW2 or other commonly used frequencies.

4.3 900 MHz Systems

L.R. Kimball found that several agencies within the AACOG region utilize LCRA 900 MHz EDACS system for primary operations. The LCRA is an enterprise providing utility services over much of Texas. The agency has a radio system used primarily for internal operation; however, excess capacity on the system allows LCRA to add public safety users to the system. The LCRA footprint covers AACOG counties of Comal, Bandera, Kendall, Gillespie, Kerr and Guadalupe. Coverage on the system is approximately 98 percent mobile, with portable coverage at approximately 85 percent. Backhaul for the system is provided via microwave and fiber.

There are several primary limitations associated with the 900 MHz LCRA system:

Non-public safety Frequency Band—The 900 MHz frequency band is not a typical band utilized for public safety operations. 900 MHz frequencies are not available for licensing by public safety agencies, and thus radio manufacturers do not typically provide public safety solutions for the 900 MHz frequency band. Subscriber options are more limited than in other frequency bands. Unique interoperability solutions are necessary for users on the 900 MHz LCRA system, while a single VHF or 800 MHz interoperability solution would be suitable for most agencies.

Interoperability—Interoperability on the 900 MHz system is limited throughout much of the region because only several agencies maintain gateways connected to the system. While the system has a regional footprint, connectivity with VHF or 800 MHz primary users is limited.

Legacy System End-of-life—The LCRA EDACS system is reaching end-of-life, and LCRA has planned to replace the system with a 900 MHz OpenSky system. Public safety users on the EDACS system must migrate to the OpenSky system, migrate to the regional 700 MHz P25 system, or identify an alternate solution. The pending decommissioning of the EDACS system is scheduled during 2014.

Proprietary Technologies—Because the 900 MHz band is not typically used by public safety, no P25 solutions exist for use in the 900 MHz frequency band.

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5. COUNTY FINDINGS

5.1 Atascosa County

Atascosa County, with an estimated population of 44,633¹, is located in the southern portion of the AACOG. The county is 1,232 square miles, of which only 3 square miles is water. Cities in Atascosa include Charlotte, Jourdanton, Lytle, Pleasanton and Poteet. The town of Christine and unincorporated areas of Campbellton, Leming, McCoy, Peggy, Rossville, Kyote and Parita comprise the remainder of the county.

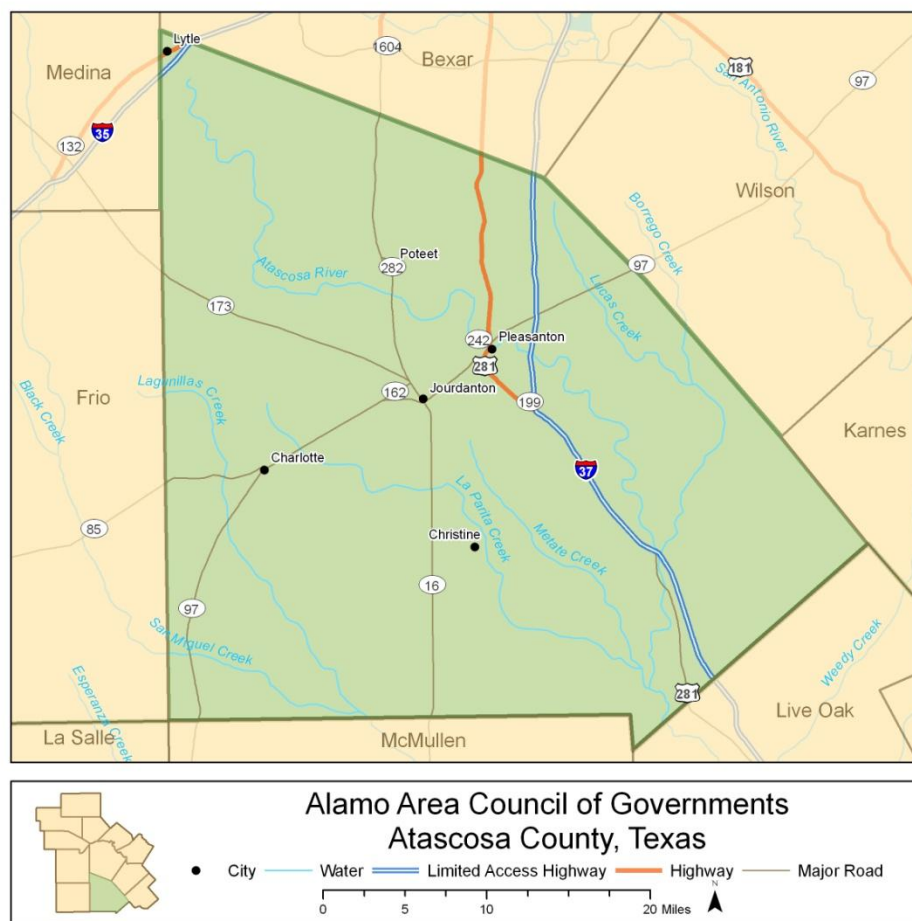


Figure 2 – Atascosa County

Through the interview and site assessment process, L.R. Kimball found that two primary radio systems are located within Atascosa County; the countywide radio system and the city of Pleasanton system. The Atascosa County

¹ 2009 Census Estimate; www.census.gov

system covers the SO and fire operations, and the Pleasanton system covers the Pleasanton PD, Jourdanton PD and the city of Poteet.

5.1.1 Radio System—County of Atascosa

5.1.1.1 System Description

The Atascosa County radio system covers the Atascosa SO and countywide fire operations. The system consists of four VHF repeaters operating in the conventional mode with voted receivers used to enhance talk back coverage. The SO uses an analog repeater for primary dispatch and a P25 digital repeater for tactical operations. FDs utilize an analog station for both dispatch and tactical operations. EMS utilizes the fourth repeater in the analog mode for dispatch operations. Leased T1 lines are utilized for backhaul on the voted network.

Separate VHF conventional systems are operated in Atascosa County by Pleasanton, Jourdanton, Lytle, and Paisano.

5.1.1.2 User Agencies

The following agencies/entities utilize the Atascosa County radio system:

Table 3 – Atascosa County User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Atascosa County SO	Law Enforcement	Not Specified	Not Specified	Not Specified
Atascosa County VFDs	Fire	Not Specified	Not Specified	Not Specified
Atascosa County EMS	EMS	Not Specified	Not Specified	Not Specified

All law enforcement agencies within Atascosa County are dispatched on the SO repeated channel. The transmitter is located one-quarter mile north of Highway 97 West at Willow Street in Jourdanton, Texas. Police dispatch is maintained in the analog mode. A digital P25 repeater has been installed that is utilized primarily for SO tactical communications. SO subscriber equipment has been upgraded to P25 and can utilize the station. The jurisdiction for the SO is countywide. Coverage was reported to have gaps in the primary response area for the SO.

The county fire portion of the radio system provides primary dispatch and tactical operations for VFDs throughout Atascosa County. A digital repeater has been installed for use by the county fire services, but will not be used for primary operations until all subscriber equipment in the various VFDs has been upgraded to P25. Jurisdiction for the county fire services is based on fire districts surrounding each of the VFDs. Volunteers are dispatched using pagers or control stations located at the various VFDs.

A separate repeater is used to dispatch EMS first responders. The county EMS services have a primary response area throughout Atascosa County.

5.1.1.3 Dispatch Facilities

Dispatch services for the Atascosa County radio systems are located at the Atascosa County SO, 1108 Campbell Avenue, in Jourdanton. The radio system interface is provided by two Motorola CENTRACOM Gold Elite consoles. The connection between the console and the repeater sites is provided by radio frequency (RF) control stations connected to yagi antennas located on the roof of the dispatch center.

The CENTRACOM Gold Elite consoles provide the ability to patch multiple channels that appear on the console. Patching is used to link users connected to repeaters on opposite sides of the county to establish wide-area coverage on an as needed basis. Patching can be utilized to interconnect users from adjacent jurisdictions that have at least one channel that appears on the Atascosa consoles.

Channels appearing on the console include:

Table 4 – Atascosa County Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Atascosa Sheriff Analog	Dispatch
Atascosa Sheriff Digital	Primary
Atascosa Sheriff EMS	Dispatch
Atascosa County Fire Analog	Dispatch/primary Tactical
Atascosa County Fire Digital	

5.1.1.4 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions, with supplemental information provided by Bandera County:

Coverage—Coverage was indicated to be the primary limitation of the existing radio systems. FDs located great distances from the repeater site have problems getting tones from the analog repeater. It is estimated that an additional transmitter at the west end of the county is needed to correct the coverage problem for the analog station. Voice communication on the digital repeater is not a problem.

Paging—Digital repeaters installed by Atascosa County do not support paging operation.

Dispatchers—Atascosa County SO requires additional personnel to sufficiently perform dispatch functions.

5.1.1.5 Radio Sites

Atascosa County provided the following radio site information:

Table 5 – Atascosa County Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Atascosa Tower	Hwy 97 & William St.	Atascosa County		Not Specified
	1220 Simmons Street			

The following radio site photographs were taken by L.R. Kimball in September 2010:



Figure 3 – Jourdanton Water Tower Radio Site

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Figure 4 – Atascosa Radio Tower



Figure 5 – Atascosa Tower Radio Shelter

5.1.1.6 Radio Inventory

Atascosa County provided the following radio equipment information:

Table 6 – Atascosa County Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Atascosa County Fire/EMS	Kenwood	Not Specified	Mobile	60
	Motorola	Not Specified	Portable	90
			Control Station	
Atascosa County SO				
	Not Specified	Not Specified	Mobile	20
Jourdanton PD				
Pleasanton PD				
Total Mobiles				
Total Portables				
Total Control Stations				
Total				

5.1.1.7 FCC Licenses

Table 7 – Atascosa County FCC Licenses

Call Sign	Location	Latitude (N)/Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
KVF676	1	28-55-19.9	98-33-31.1	155.3700 155.7300	FB FB2	91 91	100 200	117 221	20K0F3E
	2	48 km Around location 1		154.7700 154.9500	MO MO		100 100		20K0F3E
WNCR650	1	28-55-11	98-32-32	153.9500 158.7975	FB2 FB2	49 49	110 110	112 112	11K0F3E
	2	40 km Around location 1		153.9500	MO		110	110	11K0F3E
				159.0000	MO		110	110	
				156.1575 158.7975	MO MO		110 110	110 110	

Call Sign	Location	Latitude (N)/Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
	3	6.1 m control station, TX		156.1575	FX1		35	35	11K0F3E
	4	6.1 m control station, TX		156.1575	FX1		35	35	11K0F3E
WPMQ539	1	28-55-19.9	98-33-31.1	155.1225	FB2	76	100	170	11K3F3E
	2	40 km around Location 1		158.9475	FB2		15	35	11K3F3E

KVF676—Call sign KVF676 covers operation of the repeater pair 155.7300 MHz (TX) and 154.7700 MHz (RX) and the Texas common frequencies TXLAW1 and TXLAW2. This station is the primary repeater for the SO dispatch channel. The emission designator on the license (20K0F3E) covers wideband operation and needs to be updated to 11K0F3E to demonstrate narrowbanding compliance once all associated equipment has been narrowbanded.

WNCR650—Call sign WNCR650 covers the operation of two repeater stations with their associated mobiles and control stations. Operations include the analog and digital fire stations. The license has been updated with the appropriate narrowband emission designator. The mobile frequency 158.7975 MHz is not licensed as a control station and the MO (mobile) frequency 156.1575 MHz is licensed as a control station twice. Locations three and four are redundant as both are listed as 6.1 m control stations.

WPMQ539—Call sign WPMQ539 covers operation of the SO dP25 repeater. Mobile frequencies are not listed for talkaround or for control stations. The output power of the mobile frequency 158.9475 MHz is listed with an output power of 15 W when it should be 35 W. The emission designator reflects narrowband operation, but needs to be updated with the P25 emissions 8K10F1E and 8K10F1D.

5.1.1.8 System Coverage

Serious coverage problems were reported on the Atascosa County system, particularly toward the west side of the county where volunteers have difficulty receiving dispatch pages.

User reported coverage is as follows:

Table 8 – Atascosa County User Reported Coverage

Radio System Coverage	
Mobile Coverage	85%
Portable Coverage	95%
In-Building Coverage	95%

User feedback provided is questionable because portable coverage is typically lower than mobile coverage. Assuming the numbers were unintentional, 85 percent portable coverage is adequate, but less than desirable throughout the jurisdiction.

The following predicted coverage map depicts the predicted “talk out” portable coverage for Atascosa County. The map displays the strongest signal strength from all conventional tower sites. White indicates satisfactory coverage, orange indicates marginal coverage, and gray indicates limited to no coverage. The impact of voted receivers is not reflected in this map because the study demonstrates “talk out” coverage only.

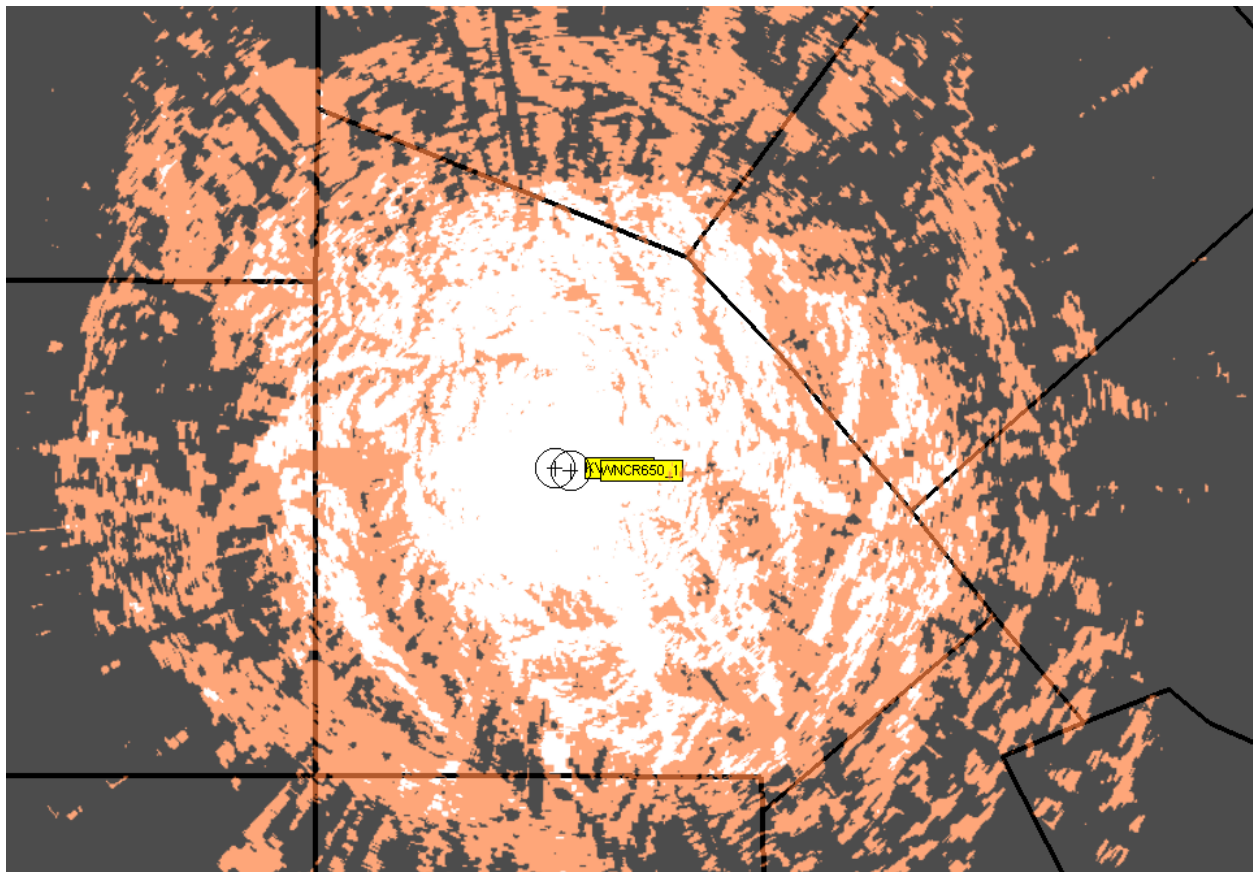


Figure 6 – Predicted Radio Coverage for Atascosa County

After comparing the predicted coverage map to feedback provided by Atascosa County, L.R. Kimball found the results to be nearly identical. Coverage is generally acceptable throughout most of the county, with the most extreme coverage problems existing toward the northwest, southwest and southeast sections of the county.

User feedback indicated FDs are missing page tones on the western side of the county. If these problems exist in both the northwest and southwest sections of the county, two sites may be necessary to provide sufficient coverage.

5.1.1.9 Future Plans

Atascosa County has no future plans in place for the radio system.

5.1.1.10 Past Expenditures

Atascosa County provided the following past radio expenditures:

Table 9 – Atascosa County Past Radio Expenditures

Year	Project Description	Total Cost	Funding Source
2009	Mobile and portable funding	\$198,000	AFG
2010	Duplexer for repeater, co-ax and antenna	\$20,000	County Funds
2008	Voting system	\$40,000	AFG
Total		\$258,000	

5.1.1.11 Future Funding

Atascosa County indicated that no future funding has been allocated for the radio system.

5.1.1.12 Assessment

Based on data collected by L.R. Kimball and information provided by Atascosa County, the following are key deficiencies noted regarding the Atascosa County radio systems:

Coverage—User feedback indicated portable coverage was limited in western portions of the county. Lack of radio coverage severely limits the ability of first responders to call for backup or alert dispatchers in the event of an emergency. Most radio systems include some “dead spots”, either in-building or in terrain-challenged areas. Dead spots over larger geographic areas are a major concern and need to be addressed.

Conventional Architecture—Present Atascosa County radio systems utilize two locations in close proximity. While the single locations with voted receivers do not create operational difficulties with a conventional architecture, the addition of radio sites to correct coverage problems will introduce operational difficulties. Conventional radio systems provide one of the simplest radio system designs available. While conventional repeaters serve as a powerful and reliable tool at minimal cost, they provide inherent technical and operational limitations. The primary limitation is the lack of coordinated radio traffic between radio sites. When a user roams outside the coverage area of a particular radio site, the user must have the wherewithal to switch channels to the next closest repeater. Users within range of two different repeaters have no ability to communicate directly with each other. Since users may reside within the coverage footprint of multiple repeaters, dispatchers must monitor and dispatch on many different frequencies; creating operational difficulties and confusion.

Site Conditions—Site surveys revealed that the present radio sites contain numerous shortcomings that could contribute to the failure of infrastructure components. Shortcomings include insufficient grounding; cable mounting; backup power; heating, ventilation and air conditioning (HVAC) systems; and site maintenance. Proper site construction and maintenance is critical to assure radio equipment continues to operate at a reliability level suitable for public safety use.

Interoperability—Interoperability in Atascosa County is limited to the use of shared VHF channels. All county systems operate in the VHF band and share frequencies to achieve interoperability. There were no interoperability gaps identified with users Atascosa County has the need to communicate with on a regular basis. However, interoperability gaps were identified with 800 MHz users on the COSA/Bexar County radio system. This limitation is significant because Bexar County borders Atascosa County, and it is likely that first responders from San Antonio will respond to Atascosa County in the event of a major interoperability event. While the Atascosa County dispatch console is a full-featured dispatch console that will support many channels and patching features, channels on the console are limited to the primary dispatch and tactical channels. No channels appear for Pleasanton, Jourdanton or Poteet. A license exists for a TXLAW2 base station; however, this channel does not appear on the console. Implementation of these channels on the console would provide for backup dispatch and increased interoperability through the use of console patches.

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5.2 Bandera County

Bandera County, with an estimated 2009 population of 20,560, is located in the western portion of the AACOG. The county is 798 square miles, of which 6 square miles is water. The city of Bandera, census-designated places of Lakehills and Medina, and unincorporated areas of Bandera Falls, Pipe Creek, Tarpley and Vanderpool comprise the county.

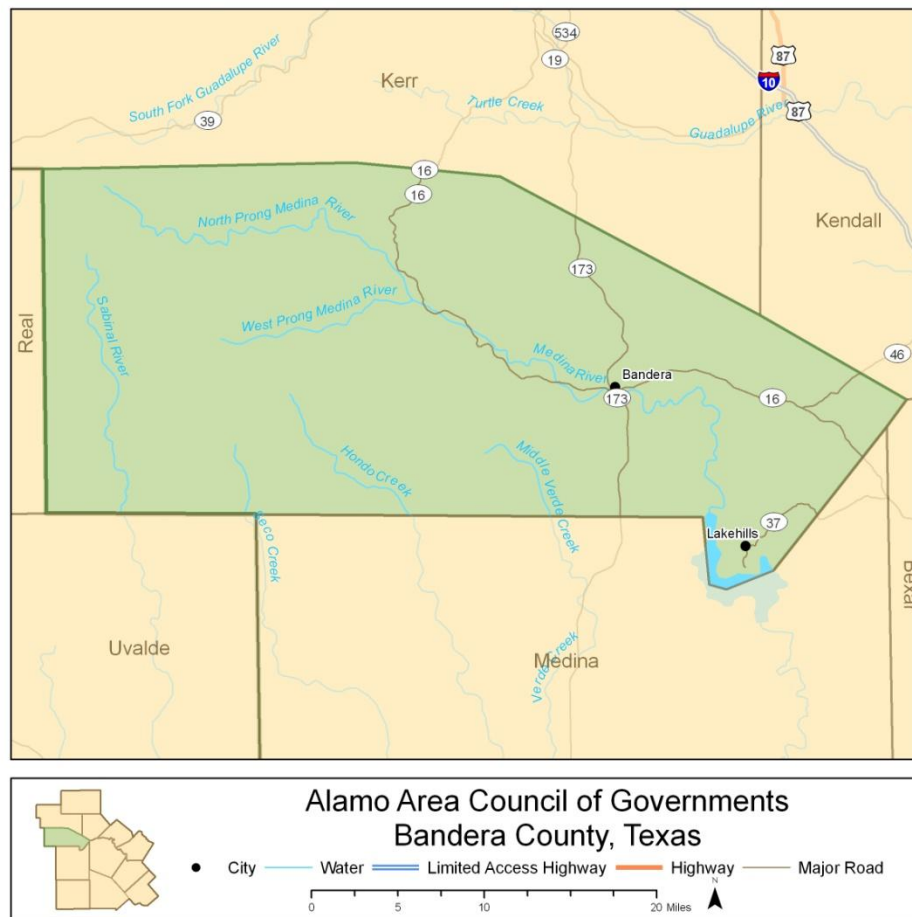


Figure 7 – Bandera County

Through the interview process, L.R. Kimball found that Bandera County includes one primary radio system, the Bandera County radio system, which provides service for all law enforcement, fire, and EMS operations within the county.

5.2.1 Radio System—County of Bandera

5.2.1.1 System Description

The Bandera County radio system includes multiple VHF conventional base station repeaters located at various tower sites throughout the county. Base stations and radio subscriber equipment (mobiles, portables and control stations) range in manufacturer and age, with some equipment dating back over 30 years. Repeater operational modes vary between wideband analog, narrowband analog and P25. Subscriber equipment is primarily narrowband capable; however, not all radios are P25 capable. Coverage and capacity on the radio system have been addressed through the addition of multiple repeaters at various locations throughout the county.

Coverage for law enforcement agencies within Bandera County is provided by two repeaters located at the primary tower in Bandera and a secondary tower in Tarpley, Texas. To maintain coverage, users switch channels depending on which section of the county they are in. Simplex interoperability channels are used (as needed) as a backup to the talkaround mode when traffic is heavy on the primary dispatch channel.

Fire and EMS operations are provided by various fire repeaters throughout the county. Primary dispatch is provided on frequency 154.9725 MHz, located in the Castle Lake subdivision.

The repeater has been established at the Civil Defense site, which is used primarily for EMC operations.

Dispatch for all systems is provided at the County dispatch center, 3360 State Hwy 173 N.

5.2.1.2 User Agencies

The following agencies/entities utilize the Bandera County radio system:

Table 10 – Bandera County User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Bandera County SO	Law Enforcement	Not Specified	Not Specified	Not Specified
Bandera PD	Law Enforcement	Not Specified	Not Specified	Not Specified
Bandera County Constables	Law Enforcement	Not Specified	Not Specified	Not Specified
Texas Highway Patrol	Law Enforcement	Not Specified	Not Specified	Not Specified
Games Wardens	Law Enforcement	Not Specified	Not Specified	Not Specified
Bandera area EMS	EMS	Not Specified	Not Specified	Not Specified
Bandera area FDs	Fire	Not Specified	Not Specified	Not Specified
Utopia Fire and EMS	Fire	Not Specified	Not Specified	Not Specified
Bandera County Fire Marshall	Fire	Not Specified	Not Specified	Not Specified
Bandera County EOC	Emergency Management	Carey Reed	830-460-8299	banderaeoc@indian-creek.net

All law enforcement agencies within Bandera County are dispatched on the SO repeated channel. The Tarpley repeater channel is used for law enforcement communications when users are located outside the coverage footprint of the primary repeater. The largest law enforcement users on the system are the Bandera County SO and the Bandera PD. Constables, highway patrol, and games wardens also use the system. The Bandera SO has primary jurisdiction throughout Bandera County, outside the city of Bandera. Coverage requirements for the SO are primarily mobile and outdoor portable; however, indoor coverage is required occasionally. Personnel are dispatched directly from their vehicles on the SO primary dispatch channel or Tarpley repeater. Coverage is limited in portions of the county that lie within the primary response area of the SO. The Bandera PD has primary jurisdiction of the Bandera city limits. While coverage requirements are primarily mobile and outdoor portable, indoor coverage is required occasionally. Coverage provided by the primary SO repeater is generally adequate within the Bandera city limits.

Dispatch for fire and EMS is provided from the repeater located in the Castle Lake subdivision. Tactical communications for VFDs throughout the county are provided either on the dispatch channel or on repeated channels operated by individual county VFDs. Bandera, Vanderpool, Medina Lake and Pipe Creek FDs operate their own radio repeaters for tactical communications. Fire/EMS users are dispatched based upon fire districts assigned to each VFD. Communications are maintained between the dispatch center and the FDs via control stations located at each of the VFDs. Paging is used as the primary method to contact volunteers. No coverage problems were indicated on the paging system. The coverage requirement for fire users is indoor portable. To supplement coverage on the fire dispatch channel, VFD fire repeaters are used for on-scene response. When coverage is insufficient on repeated channels or when multiple incidents occur at one time, traffic is off-loaded to a simplex talkaround channel, typically TXFIRE1.

5.2.1.3 Dispatch Facilities

Dispatch services for all Bandera radio systems are located at the Bandera County PSAP, 3360 State Hwy 173 N, Bandera. The radio system interface is provided by three Zetron consoles. The connection between the console and the repeater sites is provided by RF control stations connected to yagi antennas located on the roof of the dispatch center. In addition to the primary repeated channels, the console includes an interface to a base station programmed on the TXLAW2 interoperability simplex channel. Coverage on this channel is limited to the placement of the antenna at the dispatch center.

The Zetron consoles provide the ability to patch multiple channels that appear on the console. Patching is used to link users connected to repeaters throughout the county to establish wide-area coverage on an as needed basis. Patching can be utilized to interconnect users from adjacent jurisdictions that have at least one channel that appears on the Bandera consoles. Incoming interoperability traffic can be patched from TXLAW2 to other primary channels; however, coverage on TXLAW2 is limited to the immediate area surrounding the dispatch center.

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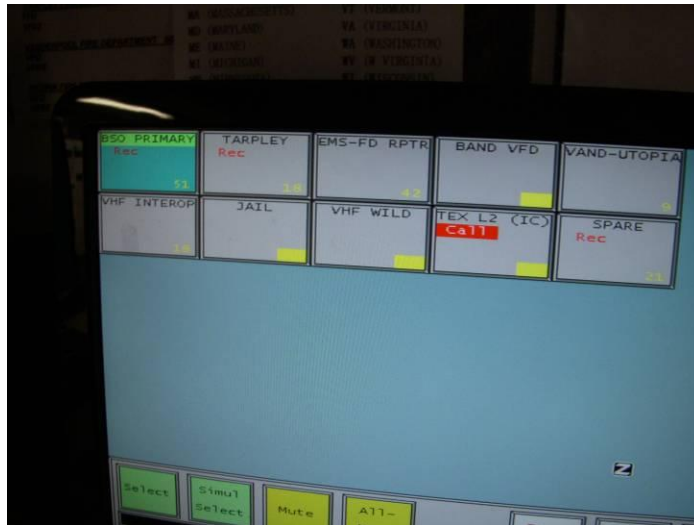


Figure 8 – Bandera County Dispatch Console

Channels appearing on the console include:

Table 11 – Bandera County Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
BSO Primary	Sheriff Primary Dispatch
Tarpley	SO Repeater
EMS FD Repeater	EMS Repeater
Band VFD	Volunteer Fire
Vand-Utopia	Volunteer Fire
VHF Interop	Interop
Jail	Jail
VHF Wild	Not Specified
Tex L2	Not Specified
Spare	Not Specified
Civil Defense	Emergency Management/Civil Defense

5.2.1.4 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

Coverage—Portable coverage was indicated to be the single biggest problem with the current radio system.

Narrowbanding—While most equipment within the county is narrowbanding capable, an effort needs to be undertaken to reprogram subscribers to operate in the narrowband mode. This is a problem particularly for the VFDs. Several of the FD repeaters are not narrowband capable and must be replaced prior to 2013.

Preventive Maintenance—Preventive maintenance is not currently being performed at the radio sites, including documentation of tower lighting, uninterruptible power supply (UPS) status, and generator fuel.

Tarpley Site—The on-site generator is not currently operational. The generator does not properly turn off when primary power is restored, consuming fuel indefinitely. The fuel tanks were currently near empty during L.R. Kimball's site visit.

Sprint Tower in Lake Hills—Sprint has offered space on the cell tower in Lake Hills for use by Bandera County. However, use of this resource will require development of the radio site, including shelter, HVAC systems, and backup power.

5.2.1.5 Radio Sites

Bandera County provided the following radio site information:

Table 12 – Bandera County Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
El Paso Energy	Indian Creek Road off of FM470	El Paso Energy		Y
Tarpley	Bar B Bar Ranch	Bar B Bar Ranch		
Civil Defense	FM 337 11 miles east of Vanderpool			
Vanderpool	Just inside Uvalde County			
Medina Lake	Lake Country subdivision			
Castle Lake	End of South Goat Ridge Road			

Bandera County provided the following radio shelter information:

Table 13 – Bandera County Radio Shelters

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
El Paso Energy					
Tarpley					
Civil Defense					
Vanderpool					
Medina Lake					

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
Castle Lake					

The photographs of the Bandera County radio tower sites were taken in 2004 and prepared for this report on August 18, 2010.



Figure 9 – Bandera SO Main Repeater

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Figure 10 – Bandera Fire Repeater Transmit

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Figure 11 – Tarpley Repeater Site



Figure 12 – Tarpley Repeater Shelter



Figure 13 – Civil Defense Tower



Figure 14 – Civil Defense Shelter



Figure 15 – Vanderpool/Utopia Repeater

5.2.1.6 Radio Inventory

Bandera County provided the following radio equipment information:

Table 14 – Bandera County Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Bandera County SO			Portable	
			Mobile	
			Control Station	
Bandera County EMS	Relm	RPV599A+	Portable	43
	Motorola	Unknown (NB)	Portable	1
	Relm	RMV50	Mobile	2
	Motorola	Unknown (NB)	Mobile	6
Bandera VFD			Portable	
			Mobile	

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
			Control Station	
Lakeshores VFD			Portable	
			Mobile	
			Control Station	
Tarpley VFD	Relm	RPV6500	Portable	10
	Relm	RMV25	Mobile	3
			Control Station	
Castle Lake VFD	Relm	RPV6500	Portable	15
			Mobile	
	Relm	RMV25	Control Station	1
Medina VFD			Portable	
			Mobile	
			Control Station	
Utopia VFD			Portable	
			Mobile	
			Control Station	
Pipe Creek VFD	Relm	RPV599A+ RPV6500	Portable	10
	Puxing	PX777	Portable	35
	Relm	RMV800, RMV25	Mobile	14
	Motorola	Unknown (NB)	Mobile	8
Medina Lake VFD			Portable	
			Mobile	
			Control Station	
Vanderpool VFD	Relm	RPV3600B	Portable	10
	Relm	RMV50	Mobile	10
	Relm	RMV50	Control Station	1
Total Mobiles				
Total Portables				
Total Control Stations				
Total				

5.2.1.7 FCC Licenses

Table 15 – Bandera County FCC Licenses

Call Sign	Location	Latitude (N) / Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WPIA341	1	29-35-57.8	99-35-58.2	154.4300	FB2	12	100	208	20K0F3E
	2	6.1 m control stations, TX		153.7700	FX1		25		20K0F3E
	3	32 km around location 1		460.6375	MO		2	20	20K0F3E
WPIA342	1	29-41-57.8	99-8-24.1	154.4300	FB2	76	100	190	20K0F3E
	2	Bandera County		153.7700 154.2800 154.4300	MO		100		20K0F3E
	3	6.1 m control station, TX		153.7700	FX1		25		20K0F3E
	4	32 km Around location 1		465.4375 465.6375	MO		2	20	20K0F3E
KNID897	1	29-45-9.8	99-27-1.2	155.9400	FB2	43	100	341	11K3F3E 11K3G2E 20K0F3E
	2	80 km around location 1		153.9800 155.9400	MO		100		11K3F3E 11K3G2E 20K0F3E
KNIH603	1	29-43-35.8	99-4-35.1	155.2050	FB	30	100	150	20K0F3E
	2	40 km around location 1		155.1600 155.2050	MO		200		20K0F3E
WPQK809	1	29-45-31.8	98-56-46.1	155.7150	FB2	331	45	100	20K0F3E
	2	32 km around location 1		153.8600 155.7150	MO		40		20K0F3E
KKS303	1	6.1 m control stations, TX		155.6100 158.9100	FX1		65	65	11K3F3E 11k3G2E 20K0F3E
	2	29-41-57.8	99-8-24.1	155.3700 155.6100	FB FB2	82	100 330	263 615	11K3F3E 11k3G2E 20K0F3E
	3	80 km around location 2		154.9500 155.6100 158.9100	MO		79		11K3F3E 11k3G2E 20K0F3E
WNSB364	1	6.1 m control stations, TX		158.7900	FX1		50		20K0F3E
	2	29-40-0.8	99-13-36.1	155.9700	FB2	59	110	135	20K0F3E

Call Sign	Location	Latitude (N) / Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
	3	Bandera County, TX		155.9700 158.7900	MO		100		20K0F3E
WQIL707	1	29-45-31.8	98-56-46.1	154.9725	FB2	58.8	90	180	11K2F1D 11K2F3E
	2	Bandera County, TX		154.9725 151.1975	MO	45	45		

WPIA341—Call sign WPIA341 covers operation of the repeater pair 154.4300 MHz (TX) and 153.7700 MHz (RX). The license covers mobile operation on the UHF frequency 460.6375 MHz; however, user feedback indicated that the UHF channel is not being used. The channel is used to dispatch Vanderpool Fire and Utopia EMS. The license does not provide mobile coverage on the RX frequency 153.7700 MHz. The 6.1 m rule only covers control stations located at fixed locations. A location is needed to cover mobile operation on this frequency. VHF licenses are protected based on mobile service area, so until the mobile frequency is licensed, Bandera County is at risk of losing this frequency to another licensee. The emission designator on the license reflects wideband operation; however, an application is currently pending under FCC file# 0004371688 to add the narrowband emissions.

WPIA342—Call sign WPIA342 covers operation of the repeater pair 154.4300 MHz (TX) and 153.7700 MHz (RX). The repeater is used by the Bandera County FD. Two UHF mobile frequencies are licensed; however, these stations are not operational. This call sign uses the same RX frequency (153.7700 MHz) as call sign WPIA341. These stations can co-exist through the use of different private line (PL) tones. However, a high potential for interference exists when both channels are being used at the same time. TXFIRE2 (154.2800 MHz) is also licensed on the call sign for mobile operation. The emission designator on the license reflects wideband operation; however, an application is currently pending under FCC file# 0004371688 to add the narrowband emissions.

KNID897—Call sign KNID897 covers operation of the repeater pair 155.9400 MHz (TX) and 153.9800 MHz (RX). The site is used as needed for all public safety disciplines, and is used to page fire and EMS in the western portion of the county. The MO frequency 153.9800 MHz is listed three times at location 2 (shown above), which is unnecessary. The call sign does not cover operation of control stations on the mobile frequency 153.9800. Narrowbanding emissions have been added to the license.

KNIH603—Call sign KNIH603 covers operation of the simplex frequency 155.2050 MHz used by Bandera road and bridge, and the mobile frequency 155.1600 MHz used by the jail. An application has been filed to add narrowbanding emissions to the license under FCC file# 0004371542.

WPQK809—Call sign WPQK809 covers operation of the repeater pair 155.7150 MHz (TX) and 153.8300 MHz (RX). The station is owned and operated by the Pipe Creek VFD. The license covers talkaround operation on the repeater frequency 155.7150 MHz, but lacks 6.1 m control stations on the license. The license reflects the wideband emission designator 20K0F3E, and requires the addition of the narrowband emission designator 11K3F3E to demonstrate narrowbanding compliance prior to January 1, 2013.

KKS303—Call sign KKS303 covers operation of the repeater pair 155.6100 MHz (TX) and 158.9100 MHz (RX). This station is the SO primary repeater. The station covers control stations on both the base and mobile frequencies, mobile talkaround for the base frequency and mobile operation on TXLAW1 (154.9500 MHz). The license covers narrowband operation; however, the narrowbanding emission was left off the control station frequency 158.9100 MHz at location 1. This emission needs to be added.

WNSB364—Call sign WNSB364 covers operations of the repeater pair 155.9700 MHz (TX) and 158.7900 MHz (RX). The station provides secondary coverage in Tarpley for the SO. The station covers both control stations and talkaround. The unit count for control stations is listed at location 1 (shown above), which is likely insufficient. The license reflects the narrowbanding emission 20K0F3E; however, an application to add the narrowbanding emissions is pending the FCC under file# 0004371680.

WQIL707—Call sign WQIL707 covers operations of the repeater pair 154.9725 MHz (TX) and 151.1975 MHz (RX). The station is utilized by Bandera EMS and Fire. The call sign covers talkaround operation, but does not cover control stations. The license is narrowbanding compliant and appears to have no critical deficiencies.

5.2.1.8 System Coverage

Coverage was indicated to be the biggest problem with the existing radio system. It is anticipated that additional radio sites will be necessary to meet the coverage requirement. Estimates of the mobile, portable, and in-building coverage were not provided.

The following map depicts the predicted “talk out” portable coverage for Bandera County. The map displays the strongest signal strength from all conventional tower sites. White indicates satisfactory predicted coverage, orange indicates moderate predicted coverage, and gray indicates limited predicted coverage.

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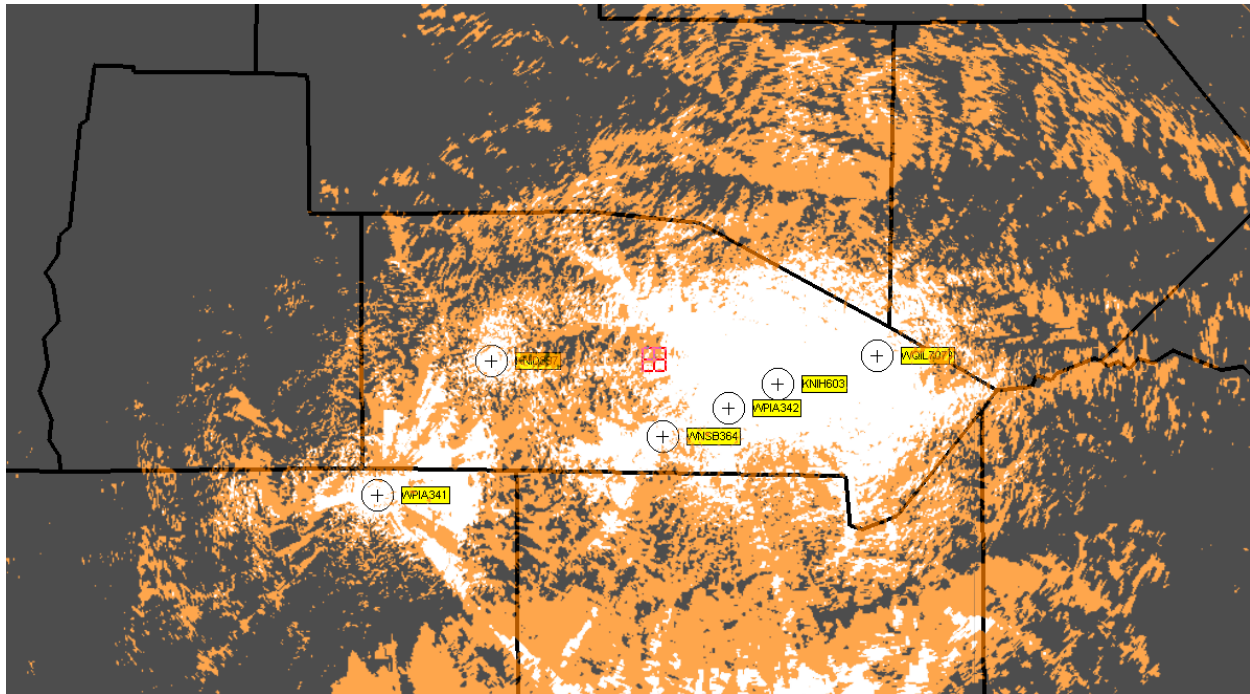


Figure 16 – Predicted Radio Coverage for Bandera County

After comparing the predicted coverage map to the feedback provided by Bandera County, L.R. Kimball found the results to be synonymous. Radio coverage appears to be a significant problem with the present radio system, particularly in the northwestern portions of the county. Coverage problems are worsened by the presence of challenging terrain, which significantly impedes the propagation of radio waves.

5.2.1.9 Future Plans

Bandera County indicated the following future plans:

- Completion of equipment replacement and reprogramming to satisfy the FCC's narrowbanding mandate by January 1, 2013
- Replacement of two repeaters at the Medina Lake tower site; one for the SO, and one for Fire/EMS
- Additional radio console to third dispatch position

5.2.1.10 Past Expenditures

Bandera County provided the following past radio expenditures:

Table 16 – Bandera County Past Radio Expenditures

Year	Project Description	Total Cost	Funding Source
2008	EMS Mobiles	\$ 3,400	County

Year	Project Description	Total Cost	Funding Source
2008	SO Radio	\$ 5,000	County
2008	Dispatch Consoles	\$49,908	County
2008	SO Radio	\$ 3,000	County
2009	EMS Mobiles	\$ 3,500	County
2010	EMS Portables	\$ 4,000	County
2009	SO Radio Tower	\$14,316	Private Grant-Motorola
2010	SO Portables	\$16,000	County
2009	Move radio equipment to new bldg	\$11,000	AACOG
2010	Jail Radios	\$ 1,000	County
2010	Civil Defense Repeater	\$ 9,000	Donation-Vanderpool VFD
2010	SO Repeater	\$14,670	County
Total		\$134,794	

5.2.1.11 Future Funding

Bandera County identified the following future funding opportunities:

Table 17 – Bandera County Future Funding Sources

Funding Source	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Texas										
PSIC	\$39,000 \$19,000									
IECGP										
AFG										
DHS										
Other										
Region	\$57,000 (Bexar Co)									
Total	\$115,000									
Total									\$115,000	

5.2.1.12 Assessment

Conventional Architecture—The present Bandera County radio system includes over eight repeaters spread across eight different repeater sites. Many of these repeaters serve overlapping coverage areas, while others provide coverage exclusively within a specific area. For a county the size of Bandera, operating in this manner can

become increasingly difficult, especially when multiple incidents occur simultaneously. Since numerous coverage problems still exist within the county, it is likely additional tower sites will be needed. If these towers are implemented in the existing conventional architecture, operational difficulties will worsen.

Multiple Sites for Overlapping Coverage Area—Both law enforcement and fire/EMS operations have jurisdictions throughout the county, yet radio sites for the services are split between different radio sites. The result is that additional resources are needed to maintain multiple radio sites that essentially serve the same geographic area. In addition, coverage footprints for law enforcement and fire operations are slightly different, potentially creating operational problems with incidents on the fringe coverage areas of the system.

Multiple Technologies—Based on the information gathered, it appears that base stations used within the system vary between wideband analog and P25 digital, with plans to upgrade the analog stations to narrowband via hardware/software updates. While upgrading systems to P25 conventional is necessary to meet the State's guidelines and provides operational benefit, implementing such systems while many users operate on radios that are not P25 compliant creates an intra-operability gap. Users on analog-only radios cannot monitor the law enforcement dispatch channel and cannot use the channel in a shared police/fire/EMS incident. Should a large-scale, multi-user event occur, loading will be placed exclusively on the analog channels.

Radio Site Conditions—While extensive radio sites and surveys were not conducted, information provided by Bandera County, including site photos and descriptions, indicated that radio sites were not up to industry specifications to assure reliable communications.

Interoperability—Interoperability today is achieved through the use of shared VHF channels. The Bandera County code plug includes channels for all Bandera frequencies, dispatch channels for adjacent jurisdictions, and TX common channels. When an interoperability event takes place between Bandera and adjacent jurisdictions, the responding agency will make a call on the primary dispatch channel. The primary limitation with this scenario is for users who do not have the appropriate frequencies programmed in their radios for the necessary coverage area. While a responding user from Kerr County may have the Bandera SO dispatch frequency programmed in their radio, they may be responding to a portion of the county outside of the appropriate coverage area. VHF users responding from beyond the adjacent jurisdictions may not have any Bandera primary frequencies programmed within their radios except for the TX common channels. While the Texas common channel – TXLAW2 – is currently the primary VHF calling channel in the state of Texas, coverage on this simplex station is limited to the footprint provided by the tower located at the Bandera PSAP. Users outside of this footprint will not be able to contact the Bandera PSAP when responding to the county. Without a data link, remote stations cannot be installed to enhance coverage on this frequency. VCALL and four VTAC frequencies have been adopted as the nationwide narrowband interoperability channels. The programming sheet provided by Bandera County indicated that these frequencies are not programmed in Bandera subscriber units. Currently, no connectivity exists at the Bandera PSAP to interconnect responding 800 MHz, 900 MHz, or UHF users to Bandera County. Should a major interoperability event occur within Bandera County, it is likely 800 MHz users from adjacent Bexar County will respond. The current system configuration provides no ability to interconnect 800 MHz users with VHF primary users.

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5.3 Bexar County

Bexar County, with an estimated 2009 population of 1,651,448, is located in the center of the AACOG. The county is 1,257 square miles, of which 10 square miles is water. The county is comprised of San Antonio and various smaller municipalities.

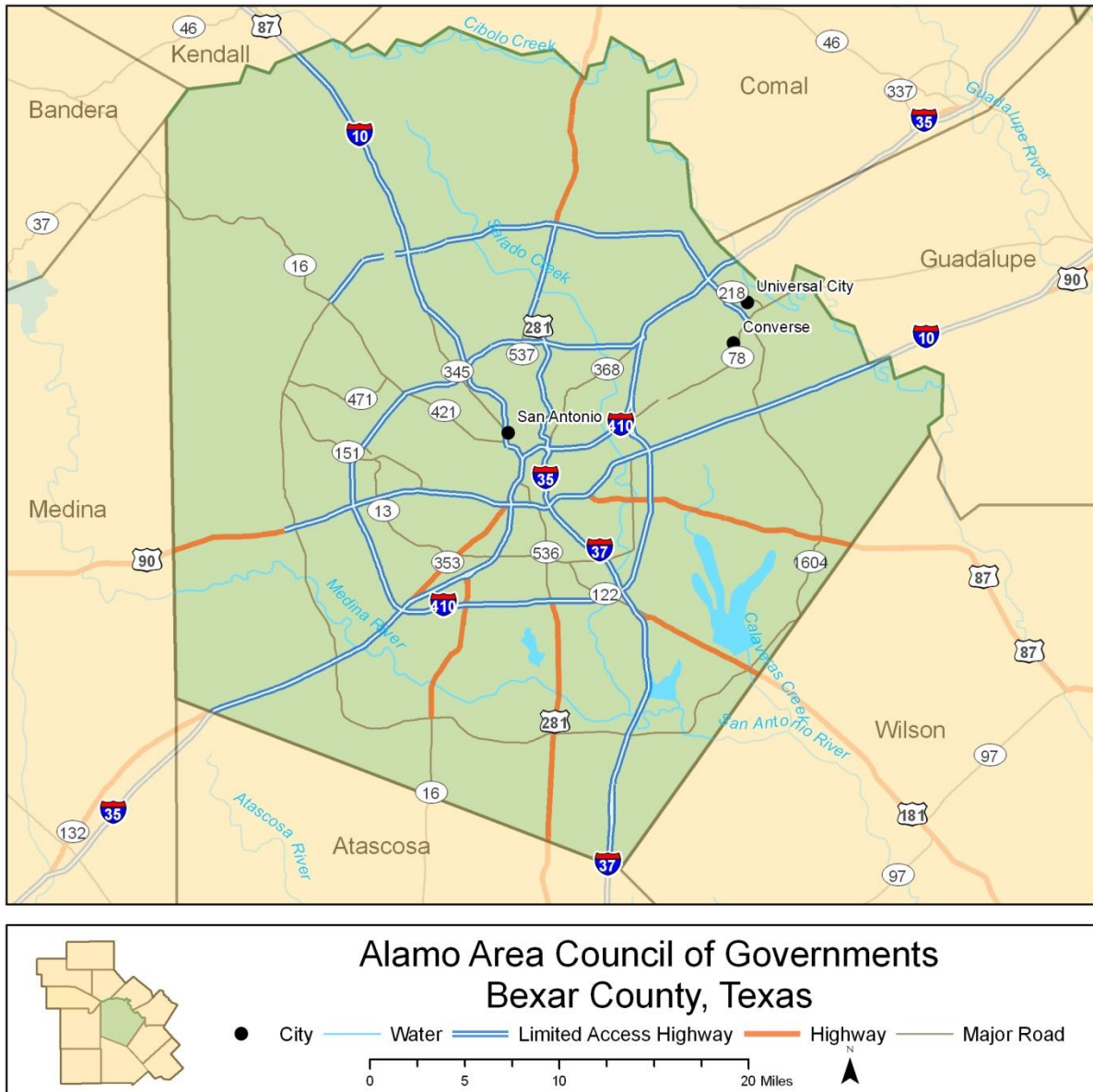


Figure 17 – Bexar County

Bexar County is the population center within AACOG. The primary radio system within Bexar County is the COSA/Bexar County 800 MHz EDACS system, which is jointly owned by the city of San Antonio and Bexar County. The system provides countywide coverage. Most municipalities within Bexar County are tenants on the COSA/Bexar County system; however, several agencies maintain their own VHF systems. A single site VHF simplex fire system, Bexar County Fire Alarm, is maintained to provide primary fire service for several VFDs throughout Bexar County. A single site EDACS system operated by Live Oak is located along the northeastern border of Bexar County, and is shared with a number of municipalities, including Selma and Shertz.

5.3.1 Radio System—COSA/Bexar County

5.3.1.1 System Description

The COSA/Bexar County system is a 12-site Harris EDACS system comprised of approximately 120 different frequencies. The system includes both simulcast and multi-cast technologies, with simulcast sites providing coverage within the San Antonio metropolitan area, inside of the interstate 410 loop, and multi-cast sites located in the outer areas of Bexar County. The simulcast portion of the system includes six sites, each with 38 different simulcast frequencies. The simulcast frequencies are split between two simulcast zones with 19 channels each. The two zones are referred to as the “blue” zone and the “gold” zone. Five National Public Safety Planning Advisory Committee (NPSPAC) multi-cast sites vary in frequency count, with six to fourteen frequencies per site. Connectivity is predominantly provided via a synchronous optical network (SONET) ring.

The system is jointly owned by San Antonio and Bexar County, with the San Antonio owning 80 percent of the system and Bexar County owning the remaining 20 percent. Other agencies within Bexar County may access the system, providing that they supply a user fee per radio to offset operating costs. Most local government agencies perform radio communications on the COSA/Bexar County system.

The system was initially procured in 1999, but was not accepted until 2004. As designed, the system provides 95 percent portable coverage, at hip level, inside a 25 dB building within the interstate 410 loop. Coverage requirements outside the interstate 410 loop are portable in a 10 dB building. To supplement coverage beyond the radio sites, two outdoor bi-directional amplifiers (BDA) are utilized to fill localized coverage gaps.

Fixed gateways are installed to interface the system with VHF and 900 MHz systems in the area, including Bexar County Fire Alarm and LCRA.

The COSA/Bexar County system owns multiple mobile gateways to be deployed in the event of a large-scale interoperability incident.

5.3.1.2 User Agencies

The following agencies/entities utilize the COSA/Bexar County radio system:

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Table 18 – COSA/Bexar County User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
San Antonio PD	Law Enforcement	Richard Morales	210-207-6387	Richard.Morales@sanantonio.gov
San Antonio FD	Fire	Richard Morales	210-207-6387	Richard.Morales@sanantonio.gov
Bexar County SO	Law Enforcement	Robert Adelman	210-335-4601	radelman@bexar.org
AACOG	Local Government	Not Specified	Not Specified	Not Specified
Alamo Community College District	Law Enforcement	Not Specified	Not Specified	Not Specified
Bexar County Hospital District	EMS	Not Specified	Not Specified	Not Specified
Bexar-Bulverde VFD	Fire	Not Specified	Not Specified	Not Specified
Castle Hills PD	Law Enforcement	Not Specified	Not Specified	Not Specified
China Grove PD	Law Enforcement	Not Specified	Not Specified	Not Specified
City of Alamo Heights	Law Enforcement	Not Specified	Not Specified	Not Specified
City of Balcones Heights	Law Enforcement	Not Specified	Not Specified	Not Specified
City of Helotes	Law Enforcement	Not Specified	Not Specified	Not Specified
City of Olmos Park	Law Enforcement	Not Specified	Not Specified	Not Specified
City of Shavano Park	Law Enforcement	Not Specified	Not Specified	Not Specified
City of Somerset	Law Enforcement	Not Specified	Not Specified	Not Specified
City of Terrell Hills	Law Enforcement	Not Specified	Not Specified	Not Specified
City of Windcrest	Law Enforcement	Not Specified	Not Specified	Not Specified
City Public Service	Public Works	Not Specified	Not Specified	Not Specified
East Central Independent School District (ISD) PD	Law Enforcement	Not Specified	Not Specified	Not Specified
Edgewood ISD PD	Law Enforcement	Not Specified	Not Specified	Not Specified
Elmendorf PD	Law Enforcement	Not Specified	Not Specified	Not Specified
Emergency Services District 2	Fire	Not Specified	Not Specified	Not Specified
Emergency Services District 7	Fire	Not Specified	Not Specified	Not Specified
Geronimo Village VFD	Fire	Not Specified	Not Specified	Not Specified
Harlandale ISD PD	Law Enforcement	Not Specified	Not Specified	Not Specified
Hill Country Village PD	Law Enforcement	Not Specified	Not Specified	Not Specified
Incarnate Word University PD	Law Enforcement	Not Specified	Not Specified	Not Specified
Judson ISD PD	Law Enforcement	Not Specified	Not Specified	Not Specified
Leon Springs VFD	Fire	Not Specified	Not Specified	Not Specified
National Security Agency	Local Government	Not Specified	Not Specified	Not Specified
Northeast ISD PD	Law Enforcement	Not Specified	Not Specified	Not Specified

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Northside ISD PD	Law Enforcement	Not Specified	Not Specified	Not Specified
San Antonio Housing Authority	Local Government	Not Specified	Not Specified	Not Specified
San Antonio ISD PD	Law Enforcement	Not Specified	Not Specified	Not Specified
San Antonio Missions National Historical Park PD	Law Enforcement	Not Specified	Not Specified	Not Specified
San Antonio Water Systems	Public Works	Not Specified	Not Specified	Not Specified
Schertz FD	Fire	Not Specified	Not Specified	Not Specified
Somerset ISD PD	Law Enforcement	Not Specified	Not Specified	Not Specified
South San ISD PD	Law Enforcement	Not Specified	Not Specified	Not Specified
Southside ISD PD	Law Enforcement	Not Specified	Not Specified	Not Specified
Southwest Texas Regional Advisory Council on Trauma (STRAC)	EMS	Not Specified	Not Specified	Not Specified
St. Mary's University PD	Law Enforcement	Not Specified	Not Specified	Not Specified
Texas A&M University PD	Law Enforcement	Not Specified	Not Specified	Not Specified
Texas Alcoholic Beverage Commission	Local Government	Not Specified	Not Specified	Not Specified
Town of Hollywood Park	Law Enforcement	Not Specified	Not Specified	Not Specified
Trinity University PD	Law Enforcement	Not Specified	Not Specified	Not Specified
Union Pacific Railroad PD	Law Enforcement	Not Specified	Not Specified	Not Specified
University of Texas at San Antonio PD	Law Enforcement	Not Specified	Not Specified	Not Specified

The San Antonio PD (SAPD) is the largest user on the radio system. The primary response area for SAPD is the San Antonio city limits. Dispatch operations are divided among multiple talk groups that correspond to geographic districts. SAPD is the exclusive user on the "blue" simulcast network. SAPD maintains the largest force of law enforcement personnel within the region, and is likely to respond to mutual aid events throughout the AACOG region.

The San Antonio Fire Department (SAFD) provides fire response throughout the incorporated areas of San Antonio, but regularly responds to shared incidents with neighboring jurisdictions. SAFD operates on the "gold" simulcast network, along with all other radio system users, with the exception of SAPD.

The Bexar County SO has primary jurisdiction throughout the unincorporated areas of Bexar County, but may respond within San Antonio or other incorporated areas within Bexar County. There are specific county-owned buildings that lie within San Antonio that have a shared response between the Bexar County SO and the SAPD. Coverage within the primary response area of the Bexar County SO is provided primarily by the six multi-cast sites that lie outside of the Interstate 410 loop.

Aside from the primary system owners, a number of local government agencies utilize the system for primary public safety communications. These users are responsible for purchasing their own subscriber equipment and must pay a subscriber fee of \$18.00 per month, plus \$500.00 a year per talk group. Radios maintained for interoperability purposes only incur a usage fee of \$1.00 a month. Most tenants maintain their own dispatch operations, although Bexar County dispatches for a select group of agencies. Users that wish to join the COSA/Bexar County system may do so via a sponsor agency. Despite the vast number of agencies who are tenants on the system, these users account for a small minority of system users.

5.3.1.3 Dispatch Facilities

Dispatch facilities on the COSA/Bexar County system are divided among the tenant agencies. 9-1-1 calls are received by the appropriate dispatch centers via selective routing on the telephone network.

The SAPD and SAFD are dispatched from police headquarters at the intersection of St. Mary's and West Houston in San Antonio. Dispatch consoles are Harris Maestros. Consoles are interfaced directly with the "blue" controller, which is co-located at the dispatch facility. Consoles are central switch-based and require a direct audio interface to the EDACS switch.

The Bexar County dispatch center is located directly across the street from the SAPD Headquarters. The center dispatches for the Bexar County SO, Bexar County Fire Alarm and five local agencies. The center includes 16 positions, 7 of which provide dispatch functions. Dispatch consoles are Harris Maestros. The "gold" controller is co-located at the Bexar County dispatch facility. Consoles are central switch-based and require a direct audio interface to the EDACS switch.

Local agencies on the system are dispatched from their respective PSAPs. All consoles utilize a control station interface to access specific talk groups on the COSA/Bexar County system. Some consoles support patching features, while others rely on San Antonio or Bexar County to establish patching when necessary.

Channels appearing on the consoles for various users on the COSA/Bexar County system include:

Table 19 – COSA/Bexar County Dispatch Tenants

Agency Name	Address	Console Type	Channels/Talkgroups on Console	Description
Castle Hills	209 Lemonwood Dr., San Antonio, TX, 78213	Not Provided	CHPP, CHEP, Shavano PD, Shavano FD, CH TAC, SAPD	
Hollywood Park	Dispatched by Bexar County			
Windcrest City	Not Provided	Not Provided	Not Provided	Not Provided
Kirby	112 Bauman, Kirby, TX, 78219	Zetron 4010	Fire Dispatch, Fire AAC, PD Dispatch, PD TAC, PW/EOC	Not Provided
Helotes	12951 Bandera Rd, Helotes, TX, 78023	M7300	HLPD, HLPDTAC1, HLPD, HLPDTAC1, HL-PS, HL0LG, 1-K, BCSO-West	Police, Police, Fire, Fire, Talkaround, Local government, Prue Rd, Bexar County W

Agency Name	Address	Console Type	Channels/Talkgroups on Console	Description
Alamo Heights	6116 Broadway, Alamo Heights, TX, 78209	Not Provided	LE, Fire and EMS	Not Provided
Balcones Heights		Zetron 4010		

5.3.1.4 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

Coverage—While the COSA/Bexar County system has been designed to very high coverage requirements, local coverage gaps still exist, specifically in terrain-challenged areas. Helotes is one particular user agency that indicated coverage gaps within their primary jurisdiction.

Capacity—While the system runs at less than 30 percent capacity under maximum load, individual multi-cast sites approach capacity limits. Additional 800 MHz spectrum is not available to address this problem. Spectrum must be re-allocated from other sites within the system. One possible solution would be to simulcast some of the rural sites.

P25—While the system was installed six years ago, efforts are underway to upgrade aging subscriber equipment to P25. Long-term goals have been set to upgrade the EDACS system to P25; however, funding is not currently available for such an upgrade, and the system is still relatively new despite the fact that EDACS is a legacy centrally switched technology. A plan is in place to install a P25 700 MHz overlay that is co-located with five of the COSA simulcast locations. This system, however, will not replace the EDACS system, and will be used exclusively for interoperability. Long-term P25 upgrades will require additional capital. Funding for a system-wide upgrade is not likely unless the costs can be incorporated with a larger municipal bond.

Interoperability—While the COSA/Bexar County system includes numerous patches to out-of-band systems in the VHF and 900 MHz bands, some tenants on the system indicated interoperability gaps with neighboring jurisdictions. This is the result an inability to perform patching at local dispatch centers.

PSAP Relocation—The SAPD is planning to relocate their dispatch facility and associated radio equipment. This relocation presents operational challenges with assuring the radio system remains operational during the transition.

Backup Dispatch—Current dispatch facilities do not provide for an effective backup system. A regional backup center is being discussed to be used by multiple agencies.

5.3.1.5 Radio Sites

COSA/Bexar County provided the following radio site information:

Table 20 – COSA/Bexar County Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
SAPD HQ	San Antonio Police HQ, St. Marys & West Houston, San Antonio, TX			Not Specified
CPS Jones Ave	326 W Jones Avenue, San Antonio, TX			Not Specified
Austin Hwy	1051B Austin Hwy, San Antonio, TX			Y
SAFD Training Academy	Fire Training Academy, Zarzamora and Centennial Avenue			Not Specified
Hy-Lions	2000 Amanda Street, San Antonio, TX	COSA/Bexar County		Not Specified
CPS Broadview	CPS Broadview: Callaghan & Evers Road, San Antonio, TX	COSA/Bexar County		Not Specified
Cagnon	1.3 Miles SSW of Intersection of Loop 1604 & FM 1957, San Antonio, TX			Not Specified
CPS Grey Forest	7439 Huermann Rd, San Antonio, TX	City Public Service		Not Specified
CPS Hill Country	19382 NW Military Hwy, San Antonio, TX	City Public Service		Not Specified
South Breeze	23706 South Breeze, San Antonio, TX	American Tower		Not Specified
CPS Toepperwein	11890 Toepperwein, San Antonio, TX	City Public Service		Not Specified
Hallmark	23002 Hallmark Road, San Antonio, TX			Not Specified

COSA/Bexar County provided the following radio shelter information (shelter dimensions are approximate):

Table 21 – COSA/Bexar County Radio Shelters

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
SAPD HQ		Concrete Pre-fabricated		Y	Y
CPS Jones Ave		Concrete Pre-fabricated		Y	Y
Austin Hwy	30' x 20'	Concrete Pre-fabricated		Y	Y
SAFD Training Academy		Concrete Pre-fabricated		Y	Y
Hy-Lions	40' x 20'	Concrete Pre-fabricated		Y	Y
CPS Broadview	15' x 40'	Concrete Pre-fabricated		Y	Y
Cagnon		Concrete Pre-fabricated		Y	Y

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
CPS Grey Forest	Unknown	Concrete Pre-fabricated		Y	Y
CPS Hill Country	15' x 30'	Concrete Pre-fabricated		Y	Y
South Breeze	15' x 20'	Concrete Pre-fabricated		Y	Y
CPS Toepperwein	15' x 20'	Concrete Pre-fabricated		Y	Y
Hallmark		Concrete Pre-fabricated		Y	Y

L.R. Kimball took the site photographs that follow.



Figure 18 – Hy-Lions Tower



Figure 19 – Hy-Lions Shelter



Figure 20 – Austin Highway Tower



Figure 21 – Austin Highway Shelter



Figure 22 – CPS Toepperwine Tower



Figure 23 – CPS Toepperwine Shelter



Figure 24 – South Breeze Tower



Figure 25 – South Breeze Shelter



Figure 26 – Hill Country Tower



Figure 27 – Hill Country Shelter



Figure 28 – CPS Grey Forest Tower



Figure 29 – CPS Broadview Tower



Figure 30 – CPS Broadview Shelter

5.3.1.6 Radio Inventory

COSA/Bexar County provided the following radio equipment information:

Table 22 – COSA/Bexar County Fixed Radio Equipment

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
SAPD HQ	Repeaters, Combiner, Multicoupler, Tower top amplifier	Harris	MASTRIII	800 MHz
CPS Jones Ave	Repeaters, Combiner, Multicoupler, Tower top amplifier	Harris	MASTRIII	800 MHz
Austin Hwy	Repeaters, Combiner, Multicoupler, Tower top amplifier	Harris	MASTRIII	800 MHz
SAFD Training Academy	Repeaters, Combiner, Multicoupler, Tower top amplifier	Harris	MASTRIII	800 MHz
Hy-Lions	Repeaters, Combiner, Multicoupler, Tower top amplifier	Harris	MASTRIII	800 MHz
CPS Broadview	Repeaters, Combiner, Multicoupler, Tower top amplifier	Harris	MASTRIII	800 MHz
Cagnon	Repeaters, Combiner, Multicoupler, Tower top amplifier	Harris	MASTRIII	800 MHz
CPS Grey Forest	Repeaters, Combiner, Multicoupler, Tower top amplifier	Harris	MASTRIII	800 MHz
CPS Hill Country	Repeaters, Combiner, Multicoupler, Tower top amplifier	Harris	MASTRIII	800 MHz
South Breeze	Repeaters, Combiner, Multicoupler, Tower top amplifier	Harris	MASTRIII	800 MHz
CPS Toepperwein	Repeaters, Combiner, Multicoupler, Tower top amplifier	Harris	MASTRIII	800 MHz
Hallmark	Repeaters, Combiner, Multicoupler, Tower top amplifier	Harris	MASTRIII	800 MHz

Table 23 – COSA/Bexar County Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
San Antonio PD and San Antonio FD	Harris	Undisclosed non-P25 800 MHz EDACS	Portables, mobiles, and control stations	8,200
Bexar County	Harris	Undisclosed non-P25 800 MHz EDACS	Portables, mobiles, and control stations	1,000
Total Mobiles				
Total Portables				
Total Control Stations				
Total				9,200

5.3.1.7 FCC Licenses

Table 24 – COSA/Bexar County FCC Licenses

Call Sign	Location	Latitude (N) / Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WNGU984	1	29-25-18.4	98-29-49.5	See License	FB2	152.4	100	1000	20K0F9W
	2	29-26-19	98-28-57	See License	FB2	128	100	1000	20K0F9W
	3	29-22-41.8	98-32-14.1	See License	FB2	86.3	100	1000	20K0F9W
	4	29-23-12.5	98-26-11.5	See License	FB2	93.6	100	1000	20K0F9W
	5	6.1 m control stations		See License	FX1		35	45	20K0F9W
	6	64 km around 29-25-37.8	98-29-7.1	See License	MO		35	45	20K0F3E 20K0F9W
	7	29-29-10.7	98-27-3.9	See License	FB2	83.8	100	1000	20K0F9W
	8	29-28-43.8	98-35-12.1	See License	FB2	117	100	1000	20K0F9W
WPTV889 WPTW791 WQCB986	1	29-32-54	98-20-34	See license	FB2	83.8	100	1000	20K0F9W
	2	29-39-44	98-27-6	See license	FB2	106.4	100	1000	20K0F9W
	3	29-37-19	98-34-14	See license	FB2	128	100	1000	20K0F9W
	4	29-38-1	98-37-49	See license	FB2	72.8	100	1000	20K0F9W
	5	29-25-8	98-43-16	See license	FB2	128	100	1000	20K0F9W
	6	64 km around 29-25-37.8	98-29-7.1	See license	MO		35	45	20K0F9W
	7	6.1 m control stations, TX		See license	FX1		35	45	20K0F9W
WPXE748	1	29-11-3.8	98-30-50	See license	FB2	228.6	100	1000	20K0F9W
	2	64 km around		See license	MO		35	45	20K0F9W

Call Sign	Location	Latitude (N) / Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
		location 1							
	3	6.1 m control stations, TX		See license	FX1		35	45	20K0F9W
WPTS276	1	29-25-18.4	98-29-49.5	866.0125 866.5125 867.0125 867.5125 868.0125	FB2	152.4	100	500	20K0F9W
	2	64 km around 29-25-37.8	98-29-7.1	821.0125 821.5125 822.0125 822.5125 823.0125	MO		35	45	20K0F9W
	3	6.1 m control stations, TX		821.0125 821.5125 822.0125 822.5125 823.0125	FX1		35	45	20K0F9W

WNGU984—Call sign WNGU984 covers operation for trunking sites in the COSA/Bexar County trunking system. The license covers the following sites:

- Location 1: COSA PD HQ
- Location 2: CPS Jones Ave
- Location 3: COSA FD Training Academy
- Location 4: Hy-Lions
- Location 7: Austin Hwy
- Location 8: CPS Broadview

These sites comprise the six simulcast sites in the system. The license covers a total of 25 frequencies at each site. The channels in this license are in the 800 MHz interleaved band, which are predominantly exempt from rebanding. Frequencies beginning with 860 MHz are in the “expansion band” and may be rebanded if desired by San Antonio and Bexar County. If San Antonio and Bexar County wish to remain in the expansion band, then Expansion Band Election (EBE) forms must be filed. Mobile operation does not cover talkaround operation.

WPTV889, WPTW791 and WQCB986—Call signs WNGU984, WPTW791 and WQCB986 cover operation for trunking sites in the COSA/Bexar County trunking system. These licenses cover the following sites:

- CPS Toepperwein
- South Breeze
- CPS Hill Country
- CPS Grey Forest

➤ Cagnon

These sites comprise five of the six multi-cast sites covering the outer areas of Bexar County. There are eight to fourteen different frequencies licensed at each of the five sites. Call signs WPTV889 and WQCB986 cover frequencies licensed in the NPSPAC band, which are subject to the rebanding initiative. Call sign WPTW791 covers frequencies in the interleaved band, which are not subject to rebanding. Frequencies beginning with 860 MHz are in the “expansion band” and may be rebanded if desired by San Antonio and Bexar County. If San Antonio and Bexar County wish to remain in the expansion band, then EBE forms must be filed. Base stations and associated subscriber equipment must be reprogrammed to operate 15 MHz below the listed frequencies.

WPXE748—Call sign WPXE748 is licensed by the City of San Antonio and covers trunking operation at the Hallmark Road site. The license covers a total of five trunked 800 MHz NPSPAC frequencies. The license reflects both old and new NPSPAC channels indicating that San Antonio is currently in the rebanding process. Following rebanding the pre-rebanded NPSPAC channels should be removed from the license. The license has been updated with the post rebanding radio service YE.

WPTS276—Call sign WPTS276 covers operations for conventional interoperability channels on the COSA/Bexar County 800 MHz system. The license includes all five NPSPAC interoperability channels, which are licensed at the Police Headquarters tower. The channels are located in the old NPSPAC band and will need to be rebanded. The station covers control station operation, but does not cover mobile talkaround.

5.3.1.8 System Coverage

Coverage on the COSA/Bexar County system was designed to meet strict performance criteria when the system was installed. Performance was designed to provide 95 percent in-building coverage for portable, at hip-level, inside a 25 dB building for areas inside the interstate 410 loop.

User feedback indicated that coverage on the system was not a concern, except in localized areas. Helotes is one such area where localized coverage was indicated to be an issue.

User reported coverage is as follows:

Table 25 – COSA/Bexar County User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	99.9%
Portable coverage	99%
In-building coverage	95%

The following coverage map depicts the predicted “talk out” portable coverage for the COSA/Bexar County system. Coverage thresholds are based on TSB-88 criteria for Harris EDACS operating in the 800 MHz NPSPAC band. All antennas were assumed to be omni-directional. Antenna heights were gathered from FCC licenses. The effective radiated power (ERP) was selected to be 300 watts for all sites, which is a high estimate based on the tower heights.

The licensed ERP of 1,000 watts was not utilized because it is far above the recognizable ERP for MASTRIII base stations. In the following map, white indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

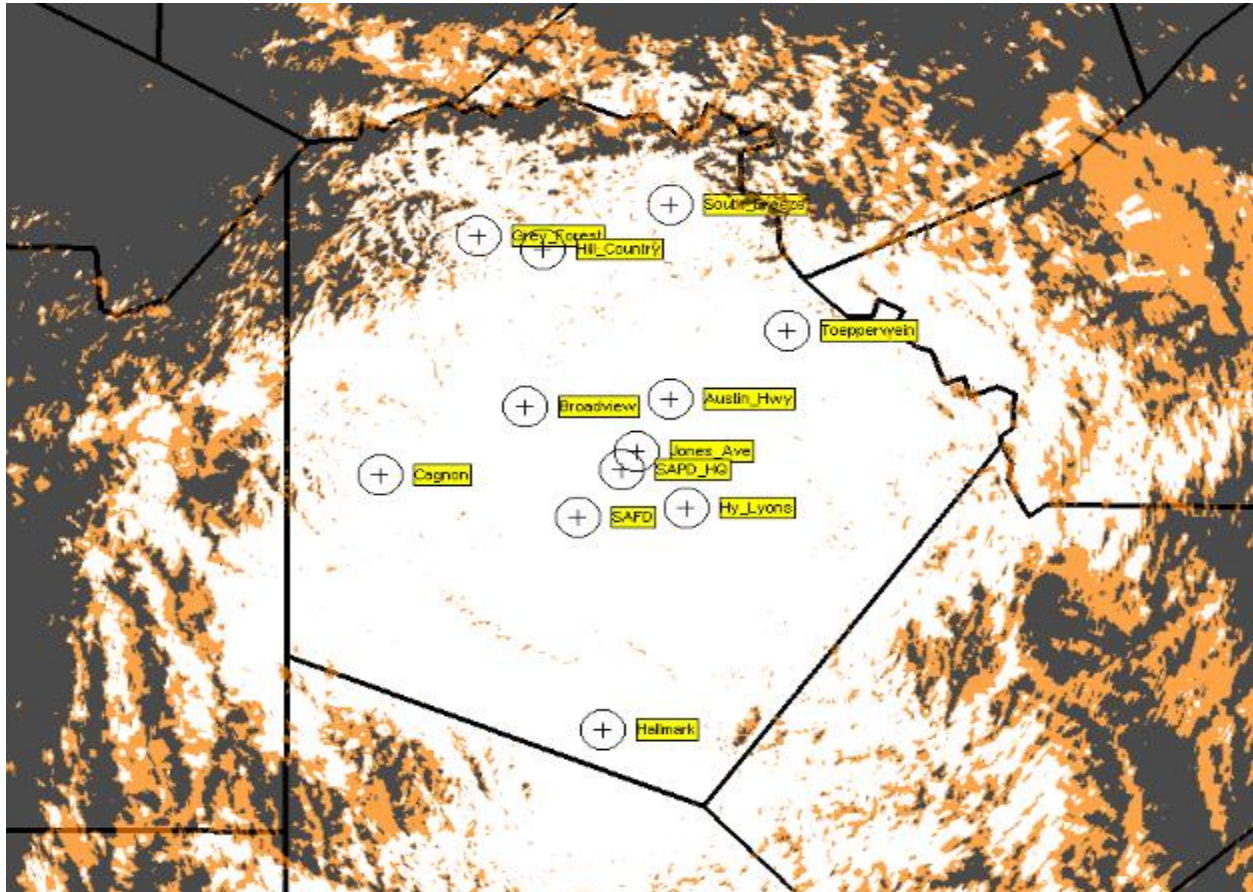


Figure 31 – Predicted Radio Coverage for COSA/Bexar County

The coverage study map confirms feedback provided by the users. Coverage on the system is excellent throughout most of the county, particularly in the center. Coverage problems are localized along the northwest border of the county where challenging terrain is introduced. These coverage problems coincide with the comments indicated by Helotes.

5.3.1.9 Future Plans

San Antonio and Bexar County indicated the following future plans:

Dispatch Center Relocation—San Antonio plans to relocate their present dispatch facility to a new location. This move will involve relocation of the 800 MHz EDACS switch.

Rebanding—The COSA/Bexar County system is currently going through the rebanding process. Radio programming associated with rebanding was scheduled for the fourth quarter of 2010.

P25 Overlay—A P25 overlay in the 700 MHz band is planned within the metropolitan center of San Antonio. The system will co-locate on five of the six simulcast sites utilized by the COSA/Bexar County system. The system is intended to provide continuous P25 coverage along the Interstate 10 evacuation corridor from Houston to San Antonio. The system will utilize a mix of state and local 700 MHz channels. The system will involve the installation of two geographically separated voice, interoperability, data, access (VIDA) switches that will support an eventual P25 upgrade for the entire COSA/Bexar County system. A VIDA switch is the central component of a Harris P25 system.

VHF Overlay—A VHF overlay is planned to improve connectivity to VHF users within Bexar County. The system will utilize two to three sites, and add additional VHF repeated channels that will be interfaced with talk groups on the 800 MHz system. Currently, Hy-Lions is the only COSA/Bexar County site that provides VHF coverage. The VHF overlay will improve interoperability with VHF users and improve VHF operability for users who remain in the VHF band within Bexar County.

Long-term Evolution (LTE)—San Antonio was awarded a waiver for access to the 700 MHz D Block broadband spectrum, and has filed a grant request for Broadband Technology Opportunity Program (BTOP) funding to build out an LTE system. If grant funding is awarded, San Antonio plans to build out an LTE system that will be integrated with the VIDA cores.

P25 Subscribers—San Antonio and Bexar County have begun the process of replacing aging subscriber equipment with P25 subscriber equipment; the process is ongoing.

P25 Upgrade—San Antonio and Bexar County have long-term goals to upgrade the entire system to P25. Because the present EDACS system is only six years old, such an upgrade is not expected within the immediate future.

Integration of Live Oak—While no firm plans have been indicated, discussions have been held to integrate the Live Oak system as part of the COSA/Bexar County system. This upgrade would require establishing backhaul connectivity to the Live Oak sites and upgrading Live Oak subscribers with system key features to operate on the COSA/Bexar County system. Live Oak subscribers would require the radio personalities to be altered to align with the COSA/Bexar County fleet maps.

Backup Dispatch Center—Currently no backup dispatch center exists that can support the capacity of San Antonio or Bexar County. A regional backup dispatch center is planned, and is currently in the site selection phase. The center is in need of permanent residents to ensure the center is operational when needed during an emergency.

5.3.1.10 Past Expenditures

San Antonio and Bexar County did not provide past radio expenditures.

5.3.1.11 Future Funding

San Antonio and Bexar County did not identify future funding opportunities.

5.3.1.12 Assessment

Interoperability—Currently, VHF interoperability on the system is limited to the simplex stations located at the Hy-Lions site. This site does not provide repeated channels for wide area coverage or a footprint to cover the county. This limits both the coverage and capacity available to responding VHF users within Bexar County. In addition, 800 MHz coverage is virtually non-existent in the AACOG outside Bexar County, which limits the ability of public safety responders to communicate if a mutual aid event occurs outside Bexar County.

P25—P25 has been identified as the technology of choice within the state of Texas. The vision within the SCIP is to implement P25 systems by 2015. While this is a vision more so than a requirement, the Texas State Interoperability Channel Plan (TSICP) identified January 1, 2015 as the date when communications on interoperability channels will be required in the P25 conventional mode. While efforts are underway to upgrade subscriber equipment to P25, it is not likely that all subscriber equipment used on the COSA/Bexar County system will be P25 compliant to operate on the interoperability channels by 2015. This limitation is primarily funding in nature.

Coverage—While coverage is adequate throughout most of Bexar County, coverage gaps still exist along the northwestern border. Coverage gaps in these areas are severe and are the result of challenging terrain.

Fragmented PSAPs—PSAP operations within Bexar County are heavily fragmented, with most municipalities performing their own dispatch operations. Such fragmentation introduces operational challenges and limits the ability of dispatch centers to coordinate cross-jurisdictional events.

Backup Dispatch—The lack of a backup PSAP that can accommodate the traffic of San Antonio or Bexar County presents a major risk in the event of a failure at the primary dispatch facilities.

Live Oak—Currently Live Oak system users cannot communicate on the COSA/Bexar County system since their radios do not support the system key features needed to operate on the system. This presents an interoperability gap. Discussions are underway to merge the two systems, which would resolve the issue.

Console Capabilities—While patching is readily available at the San Antonio and Bexar County PSAPs, many dispatch centers of tenant agencies utilize consoles with limited channel capacity and functionality. Channel patching is limited at a number of these agencies, preventing local dispatchers from establishing patches to support interoperability events.

5.3.2 Radio System—City of Alamo Heights

5.3.2.1 System Description

The city of Alamo Heights police and fire departments utilize the COSA/Bexar County 800 MHz trunked EDACS system. The City migrated to the system in 2008.

Alamo Heights maintains its own dispatch services. A total of four talk groups are assigned to Alamo Heights; one each for police dispatch and fire/EMS dispatch, and one tactical talk group for each.

5.3.2.2 User Agencies

The following agencies/entities utilize the Alamo Heights radio system:

Table 26 – Alamo Heights User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Alamo Heights PD	Law Enforcement	Richard Pruitt	210-822-6433	rpruitt@alamoheightstx.gov
Alamo Heights FD	Fire	Buddy Kuhn	210-824-1281	bkuhn@alamoheightstx.gov

5.3.2.3 Dispatch Facilities

The Alamo Heights dispatch center is located at the Alamo Heights PD at 6116 Broadway, Alamo Heights. The center includes two Zetron 4020 series consoles with LCD displays. The consoles utilize a control station interface to access talk groups on the COSA/Bexar County system.

Channels appearing on the console include:

Table 27 – Alamo Heights Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
PD	Primary PD Dispatch
Fire and EMS	Primary fire/EMS Dispatch
Additional Talk Groups	Tactical Operations and Interoperability

No secondary dispatch services are available.

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Figure 32 – Alamo Heights Dispatch Console

5.3.2.4 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions with Alamo Heights:

- Coverage, capacity, and interoperability are sufficient for Alamo Heights. The present system adequately meets the City's needs.
- The City plans to upgrade to P25 when the COSA/Bexar County system is upgraded. New subscriber radios will be needed to accommodate the upgrade.

5.3.2.5 Radio Sites

Alamo Heights is a user on the COSA/Bexar County radio system.

5.3.2.6 Radio Inventory

Alamo Heights provided the following radio equipment information:

Table 28 – Alamo Heights Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Alamo Heights FD	Harris	Miscellaneous	Portable	33
	Harris	Miscellaneous	Mobile	6

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Alamo Heights PD	Harris	Miscellaneous	Control Station	7
	Harris	Miscellaneous	Portable	4
	Harris	Miscellaneous	Mobile	0
	Harris	Miscellaneous	Control Station	0
Olmos Park FD	Harris	Miscellaneous	Portable	6
	Harris	Miscellaneous	Mobile	3
	Harris	Miscellaneous	Control Station	0
Total Mobiles				43
Total Portables				9
Total Control Stations				7
Total				59

5.3.2.7 FCC Licenses

Alamo Heights is a user on the COSA/Bexar County radio system and does not maintain system operation on any existing radio licenses.

5.3.2.8 System Coverage

Alamo Heights indicated radio system coverage on the COSA/Bexar County system was sufficient.

User reported coverage is as follows:

Table 29 – Alamo Heights User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	100%
Portable coverage	100%
In-building coverage	98%

5.3.2.9 Future Plans

Alamo Heights plans to upgrade to P25 with COSA/Bexar County. Subscriber replacements will be necessary for the upgrade.

5.3.2.10 Past Expenditures

Alamo Heights provided the following past radio expenditures:

Table 30 – Alamo Heights Past Radio Expenditures

Year	Project Description	Total Cost	Funding Source
2008	Portable Radios	\$15,000	Local Budget
Total		\$15,000	

5.3.2.11 Future Funding

Alamo Heights did not identify future funding opportunities.

5.3.2.12 Assessment

P25—The City indicated that radio replacements were needed to upgrade to P25 with the COSA/Bexar County system. While specific subscriber models were not reported, L.R. Kimball notes that Harris radios purchased in 2008 should be P25 capable, and that software upgrades are likely required. Software upgrades will be significantly less expensive than radio replacements.

5.3.3 Radio System—City of Castle Hills

5.3.3.1 System Description

The city of Castle Hills operates a VHF conventional radio system, but is currently in the process of migrating to the COSA/Bexar County 800 MHz EDACS system. Subscriber radios have been purchased to operate on the 800 MHz system.

The City operates its own dispatch facility for police and fire operations. Dispatch is also provided for the city of Shavano Park. Shavano Park is also in the process of migrating to the COSA/Bexar County system.

5.3.3.2 User Agencies

The following agencies/entities utilize the city of Castle Hills radio system.

Table 31 – Castle Hills User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Castle Hills PD	Law Enforcement	Wayne Davis	210-342-2341	wdavis@cityofcastlehills.com
Castle Hills FD	Fire	Gerald Riedel	210-342-2341	Firechief-chfd@satx.rr.com

5.3.3.3 Dispatch Facilities

Castle Hills is dispatched from the Castle Hills PD, located at 209 Lemonwood Drive, San Antonio. The City has a single console position utilizing a Director IP console. The console utilizes a control station interface to access the

COSA/Bexar County radio system and the VHF primary systems of Castle Hills and Shavano Park, which are currently being phased out.

Channels appearing on the console include:

Table 32 – Castle Hills Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
CHPD	
CHFD	
SHAVANO PD	
SHAVANO FD	
CF TAC	
SAPD	

No secondary dispatch services are available.

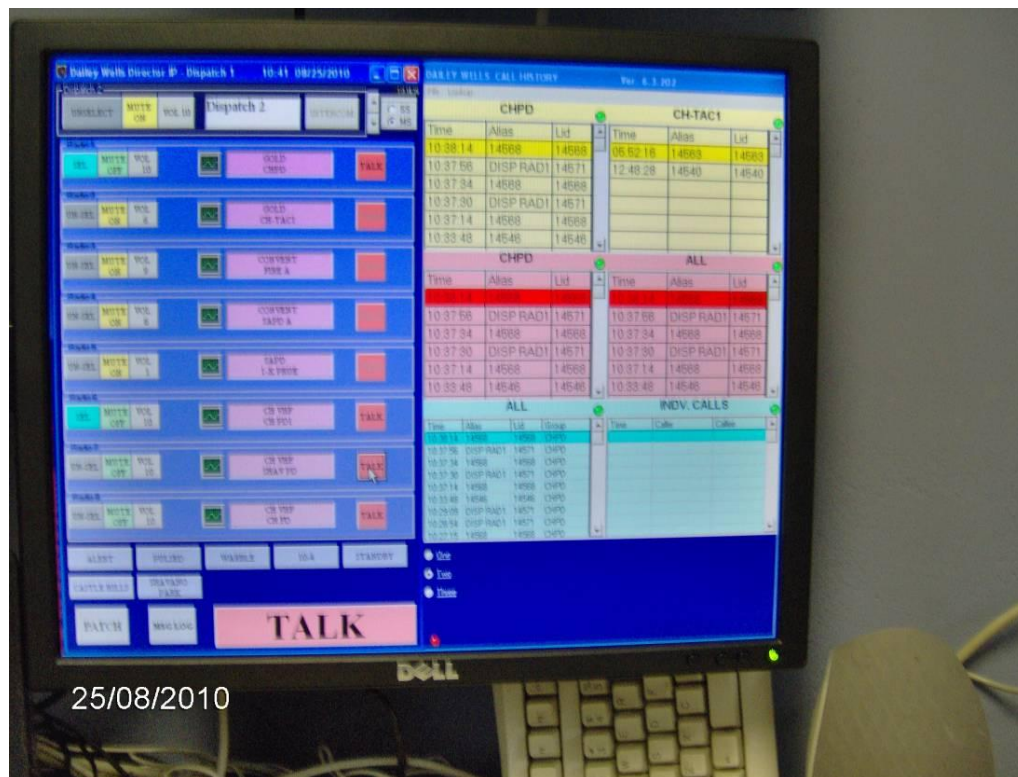


Figure 33 – City of Castle Hills Dispatch Console

5.3.3.4 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions with Castle Hills:

- Coverage on both the VHF and 800 MHz systems were reported as adequate.
- Capacity on the present VHF system is limited. Migration to the 800 MHz trunked system is anticipated to address capacity problems.
- Interoperability gaps were indicated with Alamo Hills, Terrell Hills, and Olmos Park because these agencies have 800 MHz capabilities only. Migration to the 800 MHz system is anticipated to bridge these gaps.
- Additional portable radios are needed for the migration.
- Plans are needed for interoperability with VHF primary jurisdictions after Castle Hills finishes its migration to the 800 MHz system.

5.3.3.5 Radio Sites

Castle Hills is migrating to the COSA/Bexar County radio system.

Castle Hills provided the following radio site information for the current VHF systems:

Table 33 – Castle Hills Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Castle Hills	1100 NW Loop 410	Stream Reality	~25 Years	Y

Castle Hills provided the following radio shelter information for the current VHF systems:

Table 34 – Castle Hills Radio Shelters

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
Castle Hills	Porthouse 20' x 30'				

5.3.3.6 Radio Inventory

Castle Hills provided the following radio equipment information:

Table 35 – Castle Hills Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Castle Hills FD	Motorola	HT1250	Portable	10
	Motorola	CDM1250	Mobile	4
	Motorola	CDM1250	Control Station	1
	Harris	P5470	Portable	10
	Harris	M5300	Mobile	4
	Harris	M5300	Control Station	1
Castle Hills PD	Motorola	HT1250	Portable	25
	Motorola	CDM1250	Mobile	10
	Motorola	CDM1250	Control Station	3
	Harris	P5470	Portable	24
	Harris	M5300	Mobile	7
	Harris	M5300	Control Station	6
	Hyt	TM-800V	Mobile	3
Total Mobiles				28
Total Portables				69
Total Control Stations				11
Total				108

5.3.3.7 FCC Licenses

Castle Hills is migrating to the COSA/Bexar County radio system. 800 MHz licenses are maintained by the city of San Antonio.

5.3.3.8 System Coverage

Castle Hills indicated radio system coverage on the COSA/Bexar County system was sufficient.

User reported coverage is as follows:

Table 36 – Castle Hills User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	98%
Portable coverage	98%
In-building coverage	95%

5.3.3.9 Future Plans

Castle Hills is in the process of migrating to the COSA/Bexar County radio system and has purchased subscriber radios to operate on the system. Additional portables will need to be purchased as interoperability will need to be established with VHF primary mutual aid jurisdictions following the transition.

5.3.3.10 Past Expenditures

Castle Hills provided the following past radio expenditures:

Table 37 – Castle Hills Past Radio Expenditures

Year	Project Description	Total Cost	Funding Source
2010	800 MHz Upgrade (FD)	\$50,000	Child Safety Fund
2010	800 MHz Upgrade (FD)	\$7,000	City General Funds
2010	800 MHz Upgrade (PD)	\$216,000	Crime Control Board
Total		\$273,000	

5.3.3.11 Future Funding

Castle Hills identified the following future funding opportunities:

Table 38 – Castle Hills Future Funding Sources

Funding Source	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Texas										
PSIC										
IECGP										
AFG										
DHS	\$4,000	\$4,000								
Other	\$75,000									
Region										
Total	\$79,000	\$4,000								
Total									\$83,000	

5.3.3.12 Assessment

P25—The City will need to upgrade to P25 with COSA/Bexar County. The subscriber radios purchased by Castle Hills will support P25 operation, but will require software upgrades.

Interoperability—As Castle Hills migrates to 800 MHz, interoperability gaps will likely be introduced with VHF primary jurisdictions. Tying VHF channels for mutual aid partners into the Castle Hills dispatch console will provide connectivity through a console patch solution. Alternatively, mobile radios may be maintained on both 800 MHz and VHF bands to provide ongoing VHF connectivity. Training and SOPs must be developed for the revised interoperability procedures.

5.3.4 Radio System—City of Balcones Heights

5.3.4.1 System Description

Balcones Heights police and fire departments are users on the COSA/Bexar County 800 MHz trunked EDACS system. Balcones Heights maintains its own dispatch facilities.

5.3.4.2 User Agencies

The following agencies/entities utilize the Balcones Heights radio system.

Table 39 – Balcones Heights User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Balcones Heights PD	Law Enforcement	Unknown	Unknown	Unknown
Balcones Heights FD	Fire	Unknown	Unknown	Unknown

5.3.4.3 Dispatch Facilities

Balcones Heights operates a single Zetron 4010 push button-style console with a single operator position. The console utilizes a control station interface and has access to four channels.



Figure 34 – Balcones Heights Dispatch Console

5.3.4.4 Focus Groups

Focus group data is not available for Balcones Heights.

5.3.4.5 Radio Sites

Balcones Heights is a user on the COSA/Bexar County radio system.

5.3.4.6 Radio Inventory

Balcones Heights provided the following radio equipment information:

Table 40 – Balcones Heights Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Balcones Heights PD	Harris		Portable	10
	Harris		Mobile	4
	Harris		Control Station	1
Balcones Heights FD	Harris		Portable	10
	Harris		Mobile	4
	Harris		Control Station	1
Total Mobiles				8
Total Portables				20
Total Control Stations				2
Total				30

5.3.4.7 FCC Licenses

Balcones Heights is a user on the COSA/Bexar County 800 MHz trunked system.

5.3.4.8 System Coverage

User reported system coverage is not available for Balcones Heights.

5.3.4.9 Future Plans

Future plans are not available for Balcones Heights.

5.3.4.10 Past Expenditures

Past expenditures were not provided for Balcones Heights.

5.3.4.11 Future Funding

Future funding was not provided for Balcones Heights.

5.3.4.12 Assessment

Insufficient information was provided for Balcones Heights for L.R. Kimball to provide an adequate assessment of the system.

5.3.5 Radio System—City of Helotes

5.3.5.1 System Description

The city of Helotes is in the process of migrating to the COSA/Bexar County 800 MHz trunked EDACS system. Information was not provided for the VHF systems being replaced.

Subscriber radios have been deployed on the 800 MHz system. Dispatch is provided by the city of Helotes.

5.3.5.2 User Agencies

The following agencies/entities utilize the Helotes radio system.

Table 41 – Helotes User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Helotes PD	Law Enforcement	Carrie Andrews	210-695-5932	candrews@helotes-tx.gov
Helotes FD	Fire	Carrie Andrews	210-695-5932	candrews@helotes-tx.gov

5.3.5.3 Dispatch Facilities

The Helotes dispatch center is located at the Helotes PD at 12451 Bandera Road, Helotes. The dispatch center operates two Director IP dispatch console positions. The consoles utilize a control station interface.

Channels appearing on the console include:

Table 42 – Helotes Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
HLPD	Police
HLPD TAC1	Police
HLFD	Fire
HLFD TAC1	Fire
HL-OPS	Talk around channel
HL-LG	Local government
1-K	Prive Rd (SAPD)

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
BCSO-West	Bexar County West Patrol

Secondary dispatch capability is provided by the Bexar Metro dispatch center.

5.3.5.4 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions with Helotes:

- The radio system does not have severe coverage problems; however, a tower location was negotiated with COSA/Bexar County when Helotes joined the radio system. Helotes expects the tower to be constructed within the next few years.

5.3.5.5 Radio Sites

Helotes is a user on the COSA/Bexar County 800 MHz trunked EDACS system.

5.3.5.6 Radio Inventory

Helotes provided the following radio equipment information:

Table 43 – Helotes Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
HLPD	Harris	P7200	Portable	25
HLFD	Harris	P7200	Portable	15
City of Helotes	Harris	M7300	Control Station	3
Total Mobiles				0
Total Portables				40
Total Control Stations				3
Total				43

5.3.5.7 FCC Licenses

Helotes is a user on the COSA/Bexar County 800 MHz trunked system and does not maintain operations on its VHF licenses.

5.3.5.8 System Coverage

Minor coverage problems were reported on the COSA/Bexar County 800 MHz system. A tower site was negotiated to be constructed within the Helotes city limits.

User reported coverage is as follows:

Table 44 – Helotes User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	95%
Portable coverage	95%
In-building coverage	95%

5.3.5.9 Future Plans

A tower is planned to expand coverage on the COSA/Bexar County system within the Helotes area.

5.3.5.10 Past Expenditures

Helotes did not provide past radio expenditures.

5.3.5.11 Future Funding

Helotes did not identify future funding opportunities.

5.3.5.12 Assessment

P25—The City will need to upgrade to P25 with COSA/Bexar County. The subscriber radios purchased by Helotes will support P25 operation, but will require software upgrades. Costs for these upgrades are considerable and must be kept in mind.

Coverage—Helotes is near the northwest border of Bexar County. Coverage in this area is problematic due to rough terrain. Coverage problems were reported by Helotes in the area. The planned tower placement within the Helotes area will likely address the coverage problems experienced.

5.3.6 Radio System—Town of Hollywood Park

5.3.6.1 System Description

The town of Hollywood Park is a user on the COSA/Bexar County 800 MHz trunked system and on the Bexar County Fire Alarm system. The PD utilizes the 800 MHz trunked system and is dispatched by the Bexar County SO. The FD utilizes both the 800 MHz system and the Fire Alarm VHF system and is dispatched by Fire Alarm.

The FD responds to a number of VHF primary areas and requires the ongoing use of VHF radios. Hollywood Park desires the capability to implement multi-band radios that are capable of operating on both systems.

5.3.6.2 User Agencies

The following agencies/entities utilize the Hollywood Park radio system:

Table 45 – Hollywood Park User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Hollywood Park PD	Law Enforcement	Stephen Sample	210-494-3111 ext. 230	ssample@hollywoodpark-tx.gov
Hollywood Park FD	Fire			

5.3.6.3 Dispatch Facilities

Dispatch services for Hollywood Park are provided by Bexar County.

5.3.6.4 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions with Hollywood Park:

- The City would like to purchase dual band radios capable of operating in the VHF and 800 MHz frequency bands.
- Interoperability gaps exist with Comal County who has upgraded their law enforcement radios to VHF P25. VHF radios used by Hollywood Park are not P25 capable.
- Hollywood Park will need to upgrade their equipment to P25 with COSA/Bexar County. Hollywood Park feels that outside agencies have been excluded from the upgrade process.

5.3.6.5 Radio Sites

Hollywood Park operates on the COSA/Bexar County 800 MHz trunked system and the Bexar County Fire Alarm VHF simplex system.

5.3.6.6 Radio Inventory

Hollywood Park provided the following radio equipment information:

Table 46 – Hollywood Park Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Hollywood Park	Harris	P7200	Portable	6
	Harris	P7100	Portable	2
	Harris	P700	Portable	17
	Harris	Orion	Mobile	4
	Motorola	M1225	Mobile	4
	Motorola	CDM1250	Mobile	6
Total Mobiles				14
Total Portables				25

Total Control Stations	0
Total	39

5.3.6.7 FCC Licenses

The only FCC licenses maintained for Hollywood Park are used for administrative purposes. All operational licenses belong to San Antonio or Bexar County.

5.3.6.8 System Coverage

Coverage problems were not reported on the systems.

User reported coverage is as follows:

Table 47 – Hollywood Park User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	98%
Portable coverage	98%
In-building coverage	95%

5.3.6.9 Future Plans

Hollywood Park plans to upgrade their equipment to P25 to establish interoperability with Comal County and maintain operation on the COSA/Bexar County system once it has been upgraded.

5.3.6.10 Past Expenditures

Hollywood Park did not report any radio expenditures within the last four years. The last radio purchase was in 2004 for the 800 MHz upgrade.

5.3.6.11 Future Funding

Hollywood Park did not identify future funding opportunities.

5.3.6.12 Assessment

P25—Hollywood Park indicated that it had concerns associated with the P25 upgrade of the COSA/Bexar County radio system. L.R. Kimball notes that the 7100 and 7200 series radios utilized by Hollywood Park are capable of being upgraded to P25. The Jaguar series radios cannot be upgraded and will need to be replaced. A P25 upgrade of the system is likely within a five year time frame, although no formal plans have been implemented by COSA/Bexar County to upgrade the system as of yet.

VHF Radios—The VHF radios utilized by Hollywood Park are not designed for public safety operation and lack sufficient durability and reliability requirements. Plans stated by Hollywood Park to upgrade this equipment are desirable to improve radio quality and maintain interoperability with Comal County.

Multi-band Radios—Hollywood Park stated the desire to implement multi-band radios that will operate in both the 800 MHz and VHF bands. L.R. Kimball notes that none of the multi-band radio solutions available today are capable of operating on both the present COSA/Bexar County EDACS system and the VHF band. The Motorola APX radio and the Harris Unity radio will only work once the 800 MHz system has been upgraded to P25, which is not expected for several years. Multi-band radios would, however, provide an interim solution until the EDACS system is upgraded.

5.3.7 Radio System—City of Kirby

5.3.7.1 System Description

The city of Kirby radio system provides communications for the Kirby PD, Kirby FD, and Public Works. The system consists of two VHF repeater channels located at a single site, operating in the conventional mode. Public Works uses a VHF simplex base. Dispatch is provided for police, fire, and public works. Leased radio tie lines provide connectivity between the dispatch console and the stations.

9-1-1 calls are received at the dispatch center. Police and fire/EMS response that is required within the city is dispatched directly by Kirby. If the required response is fire/EMS and is located outside of the city and within Bexar County, the fire/EMS call is dispatched directly and the incident information provided to Bexar County. The 9-1-1 call is not transferred to Bexar County. If the required response is for law enforcement services and is located outside of the city and within Bexar County, the call is transferred to Bexar County for dispatching.

VHF communications with Bexar County can occur via the dedicated VHF cross-connect at the Hy-Lions site. Bexar VHF frequencies are programmed into Kirby subscriber radios.

Kirby is in the process of migrating primary operations to the COSA/Bexar County radio system. Much of the information included in this assessment will be obsolete once Kirby migrates to the system.

5.3.7.2 User Agencies

The following agencies/entities utilize the Kirby radio system.

Table 48 – Kirby User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Kirby FD	Fire / EMS	Kevin Reidel	210-661-2612	Not Specified
Kirby PD	Law Enforcement	Chief Kevin Bois	210-661-8515	pdchief@satx.rr.com
Kirby Public Works	Public Works	Sidney Lankford	210-661-2100	Not Specified

The dispatch center is currently under the command of the Kirby PD. The new dispatch center, which is under construction, may be under the command of the Kirby FD.

Paging is used for fire and EMS operations. Fire station alerting is not currently used, although the new dispatch center/fire station under construction will use fire station alerting.

Mobile data is not used by the Kirby PD or FD.

There are 11 Emergency Service Districts to which Kirby provides support for Bexar County. Kirby PD and FD personnel carry 800 MHz portables for communications with Bexar County.

The Kirby FD subscriber radios are programmed with TXFIRE1, TXFIRE2, TXFIRE3, TXFIRE4, and TXMED1. The VCALL channel is not programmed into subscriber radios.

Interoperability is governed by the Combined Emergency Service Organization (CESO), which provides interoperability procedures for mutual aid. A revenue sharing agreement between the city of Kirby and Bexar County is governed by the revenue received by the Emergency Services Districts.

5.3.7.3 Dispatch Facilities

Dispatch services for Kirby radio systems are located at the Kirby Dispatch Center, 4130 Ackerman Road, in Kirby. A Zetron Model 4010 single position console provides dispatch capability. Connectivity to the radio system is provided by AT&T leased radio tie circuits. A backup connection between the console and the repeater sites is provided by RF control stations connected to yagi antennas on the roof of the dispatch center.

Mutual aid is provided via frequencies programmed in the subscriber units.

Channels appearing on the console include:

Table 49 – Kirby Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Police	Police Dispatch
Fire	Fire, EMS, and First Responder Dispatch
Public Works	Public Works
Inter City	
Car / Car	Talkaround

Secondary dispatch capability is provided by a Kirby FD mobile command vehicle.



Figure 35 – Kirby Dispatch Console

5.3.7.4 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions with Kirby:

- Kirby is in the process of migrating to the COSA/Bexar County 800 MHz EDACS system.
- Kirby is in the process of building a new PSAP. Fire station alerting will be implemented at the new facility.
- The VHF system has serious coverage gaps in the Bexar County service area. It is anticipated migration to the trunked system will resolve these problems.
- Numerous interoperability gaps exist with 800 MHz primary jurisdictions, including San Antonio and Live Oak. Once Kirby migrates to the COSA/Bexar County system, mutual aid talk groups will need to be acquired. Fort Sam Houston FD operates a UHF radio system and interoperability gaps are likely to persist following the 800 MHz migration.

5.3.7.5 Radio Sites

Kirby provided the following radio site information:

Table 50 – Kirby Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Kirby Water Well Site #2	107 Peppermint Lane	City of Kirby	1980	No

Kirby did not provide radio shelter information.

L.R. Kimball took the site photograph that follows in September 2010.



Figure 36 – Kirby Water Well Site #2 Radio Site

5.3.7.6 Radio Inventory

Kirby provided the following radio equipment information:

Table 51 – Kirby Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Kirby PD	Motorola	HT750	Portable	20

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
	Motorola	CDM1250	Mobile	7
Kirby PW	Motorola	HT750	Portable	5
Kirby FD	Motorola	HT750	Portable	20
	Motorola	CDM1250	Mobile	8
Total Mobiles				15
Total Portables				45
Total Control Stations				0
Total				60

5.3.7.7 FCC Licenses

Table 52 – Kirby FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WNJI201	1	29-28-04.8 N	098-22-51.1	154.070	FB2	36	110	220	20K0F3E
	2	48.0 km radius around a fixed location		154.070 159.195	MO		110		20K0F3E
KXX448	1	29-28-4.8	98-22-51.1	155.3700 155.7225	FB FB2	36	90 90	275 200	11K2F3E 20K0F3E
	2	24 km around location 1		154.9500 154.7625 159.1725	MO		40	40	11K2F3E
	3	6.1 m control stations		159.1725	FX1		25	25	11K2F3E

WNJI201—Call sign WNJI201 permits public safety transmissions on the repeater pair 154.070 MHz (TX) and 157.195 MHz (RX). This is the primary dispatch and operations channel for fire and EMS operations. The emission designator on the license (20K0F3E) allows wideband operation. The license needs to be updated to include an emission designator of 11K0F3E for narrowbanding compliance in addition to converting all transmitting equipment to narrowband transmissions.

KXX448—Call sign KXX448 is licensed by the city of Kirby and covers repeater operations on a single channel located at the primary water tank site. The repeater channel is used for primary PD dispatch. The license reflects simplex operation on TXLAW2 and mobile operation on TXLAW1. The license includes mobile talkaround and control station operation. The license reflects narrowband analog operation.

5.3.7.8 System Coverage

User reported coverage is as follows:

Table 53 – Kirby User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	90%
Portable coverage	80%
In-building coverage	70%

The coverage values include the mutual aid area of operations in Bexar County (and outside the city of Kirby). Coverage within the city jurisdiction is satisfactory and better than the values provided above. Conversion to the Bexar County 800 MHz system will remove the coverage issues for the Bexar County area of operation.

5.3.7.9 Future Plans

Kirby plans to go onto the Bexar-Metro 800 MHz trunked radio system. They will use five talk groups, which will meet their capacity requirements. Once the conversion to 800 MHz is complete, the VHF channel will be used solely for tone and voice paging. The existing VHF system will also provide a backup channel of communications, should the Bexar County system fail.

A new dispatch center and fire station is currently under construction. Construction is estimated to be completed and operations transferred to the new dispatch center by February 2011.

5.3.7.10 Past Expenditures

Kirby did not provide past radio expenditures.

All grant applications and funding requests submitted by the city of Kirby were denied. As a result, the entire cost of conversion to the Bexar County 800 MHz radio system will be paid for from the city of Kirby budget.

5.3.7.11 Future Funding

Kirby did not identify future funding opportunities.

5.3.7.12 Assessment

Narrowbanding—L.R. Kimball found that some of the equipment utilized by Kirby is still operating in a wideband mode. Migration to the COSA/Bexar County system will address narrowbanding for subscriber equipment. Wideband VHF equipment maintained for tone and paging operation must be narrowbanded.

VHF Equipment—The existing VHF fixed network equipment is approximately 20 years old and in need of replacement. Since the VHF system will be maintained for paging and backup functions, funding is needed to replace the equipment.

Interoperability—There is a need to provide a console patch between VHF and 800 MHz communications. The new console will have this capability. Once the migration to the Bexar 800 MHz system is complete, the Kirby FD will need to obtain permission from Bexar County to add the tactical (TAC) channels that Bexar Fire Alarm uses for fireground communications to their radios. Communications with SAFD, SAPD, Bexar County SO, Fire Alarm, and the city of Converse FD and PD are currently limited by the lack of 800 MHz communication capability.

Fort Houston—Fort Houston operates on the 400 MHz frequency band. There is currently no public safety-grade communications available with Fort Houston emergency service responders. Cell phones are used for the infrequent incident responses.

TAC Channels—There are an insufficient number of TAC channels for incident response in the coverage area. The addition of talk groups provided from the 800 MHz trunking system should address these concerns.

5.3.8 Radio System—City of Windcrest

5.3.8.1 System Description

The city of Windcrest is a user on the COSA/Bexar County 800 MHz trunked system. Dispatch services for the PD are provided by Windcrest. The FD operates on both the COSA/Bexar County 800 MHz trunked system and the Bexar County Fire Alarm system. Dispatch for the FD is provided by Bexar County Fire Alarm. A UHF system is maintained by Windcrest, which is used primarily for city administration and public works. The FD maintains several VHF radios for interoperability purposes.

5.3.8.2 User Agencies

The following agencies/entities utilize the Windcrest radio system.

Table 54 – Windcrest User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Windcrest PD	Law Enforcement	Trey Hall	210-655-0022 ext. 2650	thall@windcrest-tx.gov
Windcrest FD	Fire	Dan Reese	210-655-0022 ext. 2180	dreese@windcrest-tx.gov
Building Services				
Code Compliance				
Court Officer				
Windcrest Public Works	Public Works	Chris Gamboa	210-655-0022 ext. 2490	clackey@windcrest-tx.gov

5.3.8.3 Dispatch Facilities

Dispatch services for the Windcrest PD are provided at the primary PSAP located at PD. The center has a single Director IP dispatch console. Repeaters for the VHF repeater systems are located on-site on a tower located on the roof of the PD. Control stations are used to interface with the 800 MHz trunked system. A simplex base station is used to monitor the fire alarm channel.

All 9-1-1 calls are received by the Windcrest PSAP. Calls for fire response are broadcast to Fire Alarm dispatchers who then send out tone and voice pages.

Channels appearing on the console include:

Table 55 – Windcrest Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Win PD	Windcrest PD
Win PW	Windcrest Public Works
WC 1	Tactical Channel
WC 2	Tactical Channel
UHF 1	
UHF 3	
Municipal	
Fire Alarm	Windcrest FD

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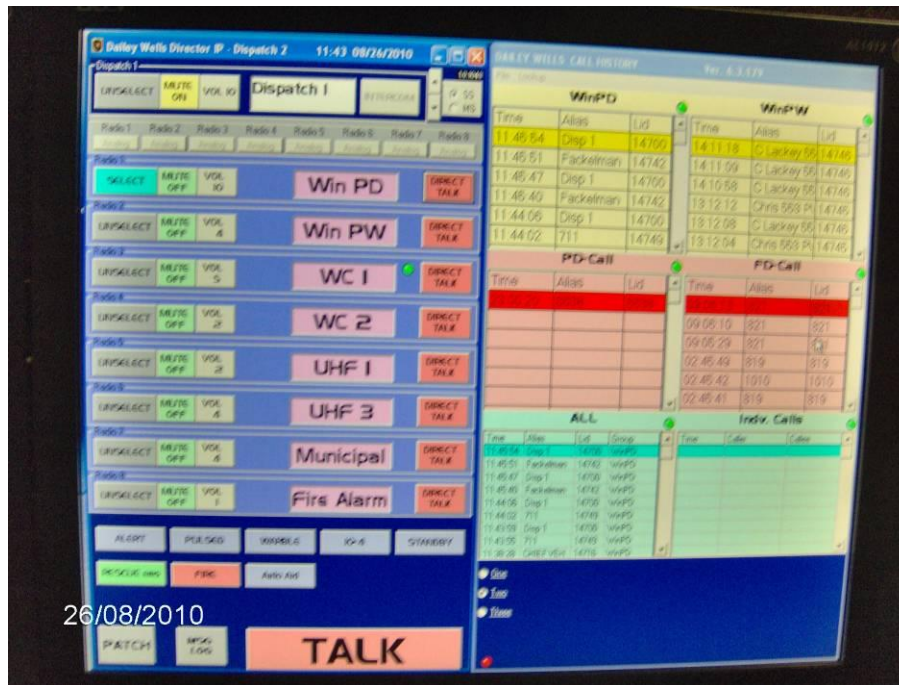


Figure 37 – Windcrest Dispatch Console

5.3.8.4 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions with Windcrest:

- Coverage and capacity is sufficient on the COSA/Bexar County 800 MHz and VHF radio systems.
- VHF paging may be performed by Hollywood Park to backup Bexar County Fire Alarm.

5.3.8.5 Radio Sites

Windcrest did not provide radio site information to L.R. Kimball.

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Figure 38 – Windcrest PD Radio Tower

5.3.8.6 Radio Inventory

Windcrest provided the following radio equipment information:

Table 56 – Windcrest Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Windcrest PD	Harris	Jaguar 700P	Portable	27
	Harris	Orion	Mobile	12
	Harris	Orion	Control Station	5
Windcrest FD	Motorola	1250	Portable	6
	Harris	P7100	Portable	5
	Harris	Orion	Mobile	6
	Harris	M7100	Control Station	1
Windcrest FD (owned by Bexar County)	Harris	Jaguar 700P	Portable	9

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Windcrest Administration	Harris	Jaguar 700P	Portable	6
	Harris	Orion	Mobile	2
Windcrest Public Works	Harris	Panther 500P	Portable	22
	Uniden	TBD	Control Station	2
Total Mobiles				20
Total Portables				75
Total Control Stations				8
Total				103

5.3.8.7 FCC Licenses

Public safety users on the Windcrest system operate on the COSA/Bexar County 800 MHz trunked system and the Bexar County Fire Alarm system.

5.3.8.8 System Coverage

No system coverage information was provided by Windcrest.

5.3.8.9 Future Plans

Windcrest did not provide future plans for the radio system. Subscriber radios will need to be upgraded to P25 when the COSA/Bexar County migration takes place.

5.3.8.10 Past Expenditures

Windcrest provided the following past radio expenditures:

Table 57 – Windcrest Past Radio Expenditures

Year	Project Description	Total Cost	Funding Source
2006	Radio System Maintenance and system fees	\$14,502	CCPD – Crime Control Tax
2006	Radio System Maintenance and system fees	\$10,072	Prevention District Authority
2007	Radio System Maintenance and system fees	\$28,442	CCPD – Crime Control Tax
2007	Radio System Maintenance and system fees	\$10,072	Prevention District Authority
2008	Radio System Maintenance and system fees	\$30,538	CCPD – Crime Control Tax
2008	Radio System Maintenance and system fees	\$10,072	Prevention District Authority
2009	Radio System Maintenance and system fees	\$13,538	CCPD – Crime Control Tax
2009	Radio System Maintenance and system fees	\$10,072	Prevention District Authority
2005-2011	Lease Purchase	\$40,570	Windcrest CCPD
2008	Purchase FD Radio Equip	\$19,640	City General Funds
2008	Purchase FD Radio Equip	\$13,000	Fire Association

Year	Project Description	Total Cost	Funding Source
2006-2010	Trunk maintenance and access fees for non-law enforcement	\$7,512	City General Funds
2008	Mutual aid – Console patch to Live Oak	\$2,400	DHS-AACOG (FY 2007)
2010	New FD Radios	\$22,000	DHS-AACOG (FY2010)
Total		\$232,400	

5.3.8.11 Future Funding

Windcrest identified the following future funding opportunities:

Table 58 – Windcrest Future Funding Sources

Funding Source	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Texas		\$30,000		\$40,000		\$50,000				
PSIC										
IECGP										
AFG							\$40,000			
DHS	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000
Other	\$70,000	\$70,000	\$70,000	\$70,000	\$70,000	\$70,000	\$70,000	\$70,000	\$70,000	\$70,000
Region										
Total	\$100,000	\$130,00	\$100,000	\$140,000	\$100,000	\$150,000	\$140,000	\$100,000	\$100,000	\$100,000
Total									\$1,160,000	

5.3.8.12 Assessment

P25—Most of the radios utilized by Windcrest are second generation subscriber radios that are not P25 capable. P25 upgrades will likely be coming within a five year time frame for the COSA/Bexar County system and a significant number of subscriber replacements are necessary for Windcrest.

Dispatch—9-1-1 calls received by Windcrest that require fire response must be relayed to Bexar County in order for paging on the Fire Alarm system. This introduces a delay that can be detrimental to emergency response times. Ideally, direct dispatch should be performed by the agency that initially answers the 9-1-1 call.

5.3.9 Radio System—Live Oak

5.3.9.1 System Description

The Live Oak radio system is a single site 800 MHz Harris EDACS trunked system with ten channels. The system is located on the northeast Bexar County border, and provides primary radio service for the municipalities of Live Oak, Selma, Universal City, Converse, and Schertz. Each entity maintains its own PSAP with separate dispatch

operations. Dispatch consoles are interfaced with control stations to the trunking system. Separate talk groups are assigned for each user agency. The system was installed in 2001 and operates in the analog mode. Most of the subscriber equipment utilized by the user agencies is vintage 2001 Jaguar and Orion radios.

The system suffers from limited interoperability with the COSA/Bexar County EDACS system due to the lack of system key features in Live Oak user radios. Plans have been discussed to connect the Live Oak system as a VDOC site on the COSA/Bexar County system; however, no formal plans have been implemented. The EDACS platform is approaching end-of-life and the system will ultimately need to be upgraded to P25. A P25 upgrade will require a replacement of most subscriber radios on the system. Coverage on the system is limited for some of the user agencies; specifically Schertz toward the east of the radio site in Guadalupe County.

Live Oak entities interoperate with numerous VHF users, primarily area FDs. Console patches and hard VHF patches are the primary means of connectivity to VHF primary users. Paging and fire station alerting are maintained by the user agencies on VHF.

5.3.9.2 User Agencies

The following agencies/entities utilize the Live Oak radio system.

Table 59 – Live Oak User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Live Oak	PD, Fire, EMS	Ronnie Rotowski	203-619-1000	
Universal City	PD, Fire, PW	Wendy Elder	203-658-5353	
Judson ISD	PD	Teresa Gonzalez	203-659-9789	
Converse	PD	T. J. Niemitz	203-658-2322	dispatch@conversetx.net
Converse	Fire and EMS	Raymond W. Christian	210-658-8900	Rayc2@hotmail.com
SCUC ISD	PD	Gary Noegle	203-945-6190	
Selma	PD	Al Zuniga	203-651-5368	
Selma	FD	Rick Brown	203-651-9150	
Schertz	PD, Fire, EMS	Glen Outlaw	210-619-1312	goutlaw@schertz.com

5.3.9.3 Dispatch Facilities

Each Live Oak user agency maintains respective dispatch facilities. Each dispatch center utilizes a control station interface for their consoles.

The Live Oak dispatch center is located at the Live Oak PD, 800 Shin Oak Drive, Live Oak. The dispatch center utilizes Zetron 4020 series consoles with a total of three positions. The city of Live Oak also dispatches for the city of Selma.

Channels appearing on the console include:

Table 60 – Live Oak Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
POLICE 1	Police Pr
CO OPS	Live Oak Operations Channel
SEL OPS	Selma Operational Channel
TRAF WAR	Traffic Warrant Channel
SEL FIRE	Selma Fire Dept
METRO TAC	Metropolitan Tactical Channel
LO FD	Live Oak PD 800 to VHF Fire Department Hard Gateway
SEL FD	Selma FD VHF
SCHERTZ EMS	Schertz EMS channel



Figure 39 – Live Oak Dispatch Center



Figure 40 – Live Oak Console Interface

The Converse dispatch center is located at the Converse PD, 402 S Seguin in Converse. The center operates two Harris Director IP consoles.

Channels appearing on the console include:

Table 61 – Converse Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Converse	
Conv OPS	
Wide Area	
Traffic	
Fire TAC	
Fire 800	
Public Wks	
Fire Page	

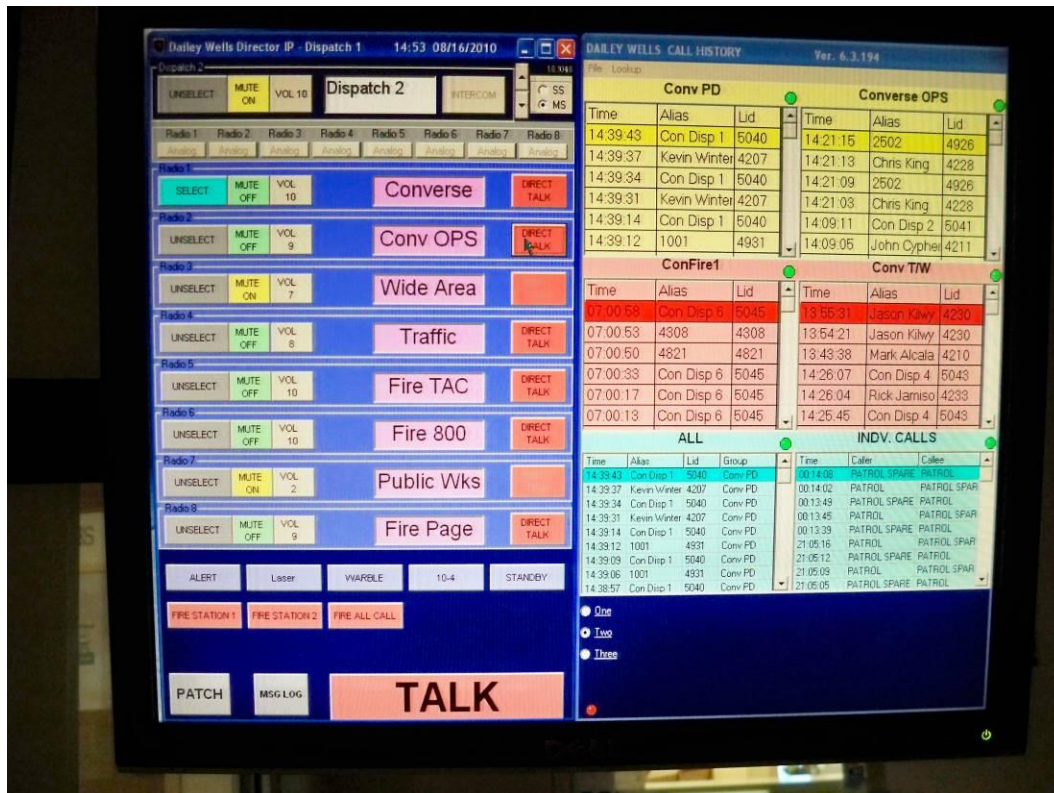


Figure 41 - Converse Dispatch Console

The Universal City dispatch center is located at the Universal City PD, 2150 Universal City Blvd. in Universal City. L.R. Kimball was unable to survey the Universal City dispatch center. Additional information regarding Universal City dispatch operations has not been provided.

Information regarding the Schertz dispatch facilities is provided in the Guadalupe County section.

5.3.9.4 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions with Live Oak system users:

- Coverage on the system is limited toward the eastern border, which primarily impacts the city of Schertz. An additional radio site in a simulcast configuration is desired to improve coverage in this area.
- Interoperability is limited with COSA/Bexar County due to a system key feature that is missing from the Live Oak users' subscriber radios.
- Interoperability gaps exist with the VHF primary entities of Guadalupe County and Comal County.
- Discussions have been held to integrate the Live Oak system as a site on the COSA/Bexar County system.

5.3.9.5 Radio Sites

Live Oak provided the following radio site information:

Table 62 – Live Oak Radio Site

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Live Oak Tower	13989 IH 35N	City of Live Oak	9 Years (Water tank)	Y

Live Oak provided the following radio shelter information:

Table 63 – Live Oak Radio Shelter

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
City of Live Oak	12' x 16'	Block	2001	Y



Figure 42 – Live Oak Water Tank

5.3.9.6 Radio Inventory

Live Oak provided the following radio equipment information.

Table 64 – Live Oak Fixed Radio Equipment

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
Live Oak	10 repeaters	Harris	MASTRIII	800 MHz
	Combiner			800 MHz
	Multicoupler			800 MHz
	System Controller	Harris		

Table 65 – Live Oak Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Schertz / Cibolo ISD	Harris	P7100 / P5100 / P5400 / LPE 200 / 700 P	Portable	51
	Harris	M7100 / Orion	Mobile	6
	Harris	M7100 / Orion	Control Station	1
Live Oak PD / Fire	Harris	P7100 / P5100 / P5400 / LPE 200 / 700 P	Portable	75
	Harris	M7100 / Orion	Mobile	67
	Harris	M7100 / Orion	Control Station	5
Selma PD / Fire	Harris	P7100 / P5100 / P5400 / LPE 200 / 700 P	Portable	39
	Harris	M7100 / Orion	Mobile	22
	Harris	M7100 / Orion	Control Station	1
Judson ISD	Harris	P7100 / P5100 / P5400 / LPE 200 / 700 P	Portable	16
	Harris	M7100 / Orion	Mobile	1
Universal City PD, Fire, PW	Harris	P7100 / P5100 / P5400 / LPE 200 / 700 P	Portable	64
	Harris	M7100 / Orion	Mobile	43
	Harris	M7100 / Orion	Control Station	6
Converse PD / Fire	Harris	P7100 / P5100 / P5400 / LPE 200 / 700 P	Portable	57
	Harris	M7100 / Orion	Mobile	38
	Harris	M7100 / Orion	Control Station	1
Total Mobiles				177
Total Portables				302

Total Control Stations	14
Total	493

5.3.9.7 FCC Licenses

Table 66 – Live Oak FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WPWD493	1	29-34-7.8	98-20-21	851.0125 851.3250 851.8250 852.5875 852.8875 853.1125 853.3375 853.5625 853.6750 853.7875 853.9125	FB2	49.5	100	490	13K0F2D 14K0F3E
	2	25 km around location 1		806.0125 806.3250 806.8250 807.5875 807.8875 808.1125 808.3375 808.5625 808.6750 808.7875 808.9125 851.0125 851.3250 851.8250 852.5875 852.8875 853.1125 853.3375 853.5625 853.6750 853.7875 853.9125	MO		35	35	13K0F2D 14K0F3E
	3	6.1 m control stations		806.0125 806.3250 806.8250 807.5875	FX1		35	35	13K0F2D 14K0F3E

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
				807.8875 808.1125 808.3375 808.5625 808.6750 808.7875 808.9125					
	4	25 km around location 1		851.5125 852.0125 852.5125 853.0125	FB2T		100	100	14K0F3E
	5	29-27-52.8	98-28-41	851.3250 851.8250 852.5875 852.8875 853.1125 853.3375 853.5625 853.6750 853.7875 853.9125	FB2	58.4	100	350	13K0F2E 14K0F3E

WPWD493—Call sign WPWD is licensed by the city of Live Oak and covers the primary 800 MHz trunked frequencies used on the Live Oak system. The call sign is licensed with the radio service YE on the post rebanding NPSPAC channels, indicating that Live Oak has completed rebanding. A total of ten trunked frequencies are covered on the license. The license includes the 800 MHz NPSPAC interoperability channels. The 8CALL90 channel is licensed as a permanent repeater frequency, while the four tactical frequencies are licensed as temporary repeaters. The interoperability channels are conventional channels and should technically be licensed under the conventional radio service GE. A second location is licensed in the city of San Antonio with the ten trunked frequencies; however, it is not believed that a second radio site has been constructed in San Antonio. The emission designators are not recognized for analog operation in the NPSPAC band.

5.3.9.8 System Coverage

Minor coverage problems were reported on the Live Oak radio system. Coverage is most problematic east of the radio site over parts of the Schertz jurisdiction.

User reported coverage is as follows:

Table 67 – Live Oak User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	95%
Portable coverage	90%
In-building coverage	90%

Table 68 – Converse User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	95%
Portable coverage	90%
In-building coverage	Varies

The following coverage map depicts the predicted “talk out” portable coverage for the Live Oak radio system. Coverage thresholds are based on TSB-88 criteria for Harris EDACS systems operating in the 800 MHz NPSPAC band. All antennas were assumed to be omni-directional. Antenna heights were gathered from FCC licenses. The effective radiated power (ERP) was based on FCC licenses. In the following map, white indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

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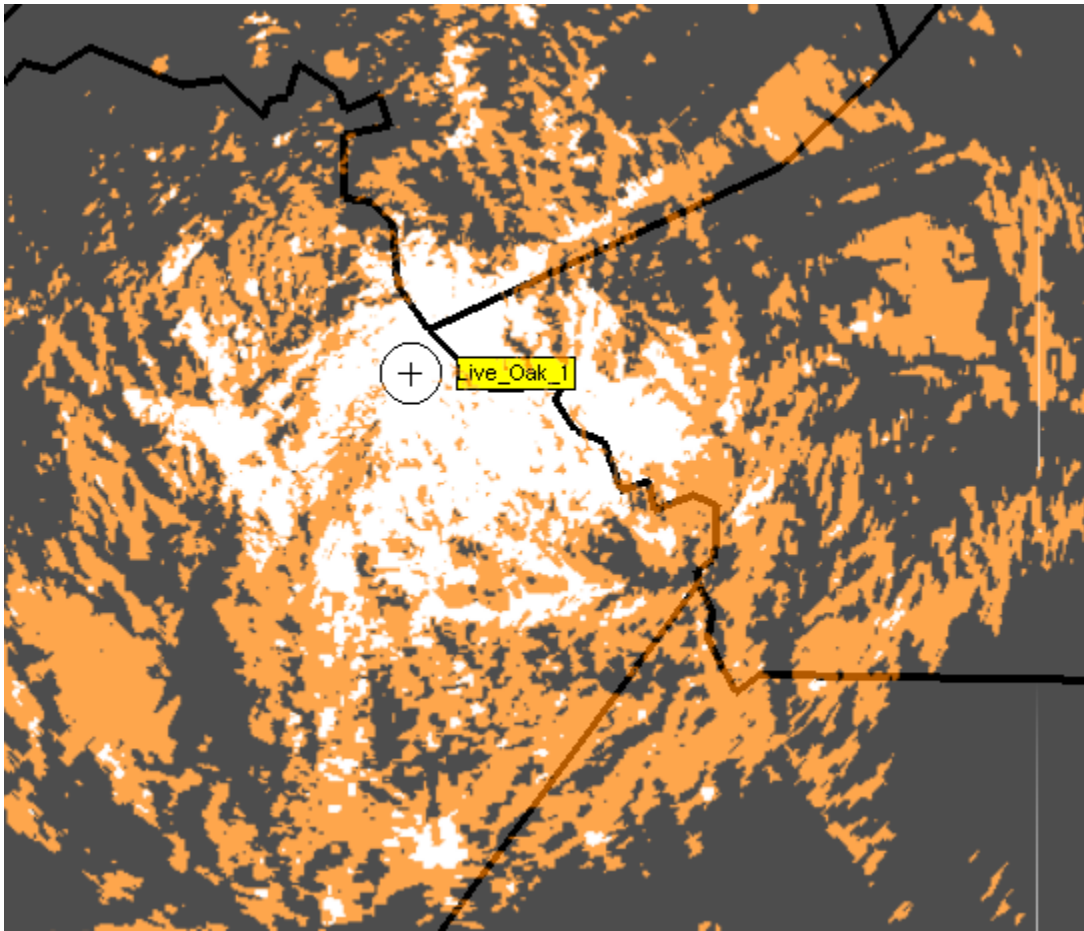


Figure 43 - Live Oak Radio Coverage

Predicted coverage on the Live Oak system indicates that the system provides localized coverage within the Bexar County, Guadalupe County, and Comal County border areas. The user agencies on the system are localized within the coverage area and thus do not experience significant coverage gaps. Coverage degrades quickly in Guadalupe County, which explains the coverage problems experienced by the city of Schertz. Because the system provides limited wide area coverage, interoperable communications will be limited for the Live Oak users when outside of the primary jurisdiction.

5.3.9.9 Future Plans

No firm plans were indicated for the Live Oak radio system. Discussions have been held to integrate the Live Oak system with the COSA/Bexar County system. A need has been expressed to add a radio site to expand coverage to the east. The system will ultimately need to be upgraded to P25, requiring a replacement of most subscriber radios. It is likely that the Live Oak system will upgrade to P25 at the same time as COSA/Bexar County. The joint upgrade will be a necessity if Live Oak merges with the COSA/Bexar County system.

5.3.9.10 Past Expenditures

Live Oak, Universal City, Converse and Selma did not provide past radio expenditures.

5.3.9.11 Future Funding

Live Oak, Universal City, Converse and Selma did not identify future funding opportunities.

5.3.9.12 Assessment

Interoperability—Interoperability is perhaps the greatest concern for the Live Oak radio system. Lack of connectivity with users on the COSA/Bexar County system is a major gap that should be corrected as soon as possible. The systems operate on equivalent technologies in the same frequency band. Integrating the Live Oak system with COSA/Bexar County will address these gaps. Interoperability between the agencies is currently limited to conventional interoperability channels. Live Oak system users are situated in the border area of multiple jurisdictions operating on non-interoperable systems. Comal County is operating a P25 conventional system; New Braunfels is operating on the 900 MHz LCRA system; and Guadalupe County is in the process of migrating to the Kenwood NEXEDGE platform. The 700 MHz P25 interoperability layer has been expanded from Guadalupe County into Bexar County. Maintaining interoperability with all neighboring jurisdictions will be a challenge, both technically and operationally.

Coverage—Coverage on the Live Oak system is adequate throughout most of the primary system users' areas; however, some localized coverage gaps exist for the city of Schertz. Because the system does not provide wide area coverage, radio users on the system have limited connectivity beginning several miles away from the primary transmitter location. Plans to add an additional radio site will improve coverage on the system. Integration with the COSA/Bexar County system and P25 upgrades will greatly expand the service area within which Live Oak radio users can communicate.

P25—Most of the Live Oak radio equipment is last generation subscriber equipment that was purchased when the system was installed in 2001. Most of this equipment is not P25 capable and will need to be replaced. An upgrade plan and funding have not yet been identified by Live Oak users. The upgrade will require a substantial investment. It is the State's goal to implement P25 systems across the state by 2015. Live Oak users must prepare for the upgrade.

Narrowbanding—VHF subscriber radios were not identified by user agencies other than Schertz. While VHF radios are not used by other agencies, paging and alerting systems were reported. An analysis must be done to determine if these systems are narrowbanding compliant.

Consoles—Users on the Live Oak system utilize control station-based consoles instead of trunking consoles directly interfaced with the radio system. The consoles require separate control stations for each channel and limit the features available on the console.

5.3.10 Radio System—Leon Valley

5.3.10.1 System Description

The city of Leon Valley is a municipality within Bexar County that operates a single site VHF conventional radio system with two repeater channels. A separate channel is utilized for law enforcement and fire operations. A separate repeater is utilized for Leon Valley municipal services. Radio fixed infrastructure and subscriber radios are manufactured by Motorola. The present system and equipment is narrowband capable and was installed in 2008. Reprogramming is needed for the radio equipment to operate in a narrowband mode. Leon Valley maintains its own dispatch operations at the Leon Valley PD. Paging and fire station alerting are maintained on the system.

The system provides adequate coverage within the Leon Valley area, which is limited to several miles.

5.3.10.2 User Agencies

The following agencies/entities utilize the Leon valley radio system.

Table 69 – Leon Valley User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Leon Valley PD	Law Enforcement	Robert Lee	210-684-3219	r.lee@leonvalleytexas.gov
Leon valley FD	Fire	Robert Lee	210-684-3219	r.lee@leonvalleytexas.gov
Leon Valley PW	Public Works	Byron Vick	210-681-1232	

5.3.10.3 Dispatch Facilities

The city of Leon Valley dispatch center is located at the PD. The center operates Zetron 4010 consoles with two positions. The consoles utilize a leased T1 line to interface with the repeater site. A cross-band interface designed by Industrial Communications is used to patch the Leon Valley primary channels with talk groups on the COSA/Bexar County 800 MHz system.

Channels appearing on the console include:

Table 70 – Leon Valley Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Leon valley Fire	
Leon Valley PD	
Leon Valley Public Works	
Intercity Base	LAW1
Intercity Mobile	Law 2



Figure 44 – Leon Valley Dispatch Console



Figure 45 – Leon Valley 800 MHz Interface

5.3.10.4 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions with Leon Valley system users:

- The City experiences some interference problems on the VHF primary channels.
- The City wishes to have data capability on the radio system. Currently data is provided in law enforcement vehicles through wireless area cards.
- Leon Valley would like to see an eventual migration to P25.
- Leon Valley would like to establish permanent talk groups on the COSA/Bexar County system.

5.3.10.5 Radio Sites

Leon Valley provided the following radio site information:

Table 71 – Leon Valley Radio Site

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Grass Hill Water Tank	Leon Valley	Leon Valley	30	Y

Leon Valley provided the following radio shelter information:

Table 72 – Leon Valley Radio Shelter

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
Grass Hill Water Tank	8' x 8'	Block	1980	Y	N

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Figure 46 – Leon Valley Water Tank

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Figure 47 – Leon Valley Radio Shelter

5.3.10.6 Radio Inventory

Leon Valley provided the following radio equipment information.

Table 73 – Leon Valley Fixed Radio Equipment

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
Grass Hill FD	Repeater System	Motorola	MTR2000	154.1450 (TX) 203.5 Hz (CTCSS) 151.10000 (RX) 210.7 Hz (CTCSS)
Grass Hill PD	Repeater System	Motorola	MTR2000	154.7250 (TX) 155.5800 (RX) 203.5 Hz (CTCSS)
Grass Hill Municipal	Repeater System	Motorola	MTR2000	153.8750 (TX) 158.9250 (RX) 203.5 Hz (CTCSS)

Table 74 – Leon Valley Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
LVFD	Motorola	HT1250	Portable	30
	Motorola	MCS2000	Mobile	10
	GE/Harris	Phoenix	Mobile	2
	Motorola	MCS2000	Control Station	2
LVPD	Motorola	CDM1550	Mobile	12
	Relm		Portable	49
Total Mobiles				24
Total Portables				79
Total Control Stations				2
Total				105

5.3.10.7 FCC Licenses

Table 75 – Leon Valley FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
KYU874	1	VIC: LEON VALLEY TX		154.9500 155.5800	MO		110		20K0F3E
	2	29-29-19.8	98-36-38.1	155.3700 154.7250	FB FB2	49 55	110		20K0F3E
KBQ204	1	29-29-19.8	98-36-38.1	154.1450	FB2	49	110	110	20K0F3E
	2	32 km around location 1		151.1000 154.1450	MO		110		20K0F3E
KWO464	1	29-29-19.8	98-36-38.1	153.8750	FB2	55	110	225	20K0F3E
	2	48 km around location 1		158.9250	MO		110		20K0F3E

KYU874—Call sign KYU874 is licensed by the city of Leon Valley and covers the operation of the primary repeater channel utilized by the Leon Valley PD. The license also covers mobile operation on TXLAW2 and simplex operation on TXLAW2. The repeater channel does not include mobile talkaround or control station operation. The mobile service area VIC is not recommended as there are no associated political boundaries with which frequency coordinators can protect the frequencies.

The license reflects wideband operation; however, an application is currently pending at the FCC to add narrowband and P25 emissions.

KBQ204—Call sign KBQ204 is licensed by the city of Leon Valley and covers the operation of the primary repeater channel utilized by the Leon Valley FD. The license includes mobile talkaround, but does not include control stations.

The license reflects wideband operation; however, an application is currently pending at the FCC to add narrowband and P25 emissions.

KWO464—Call sign KWO464 is licensed by the city of Leon Valley and covers the operation of the primary repeater channel utilized for Leon Valley municipal services. The license does not include mobile talkaround or control stations. The frequencies are licensed on a secondary non-interference basis.

The license reflects wideband operation; however, an application is currently pending at the FCC to add narrowband and P25 emissions.

5.3.10.8 System Coverage

Coverage problems were not reported on the Leon Valley radio system. The service area is very small and localized around the transmitter location.

User reported coverage is as follows:

Table 76 – Leon Valley User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	100%
Portable coverage	100%
In-building coverage	95%

The following coverage map depicts the predicted “talk out” portable coverage for the Leon Valley radio system. Coverage thresholds are based on TSB-88 criteria for wideband analog VHF systems. All antennas were assumed to be omni-directional. Antenna heights and ERP values were gathered from FCC licenses. In the following map, white indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

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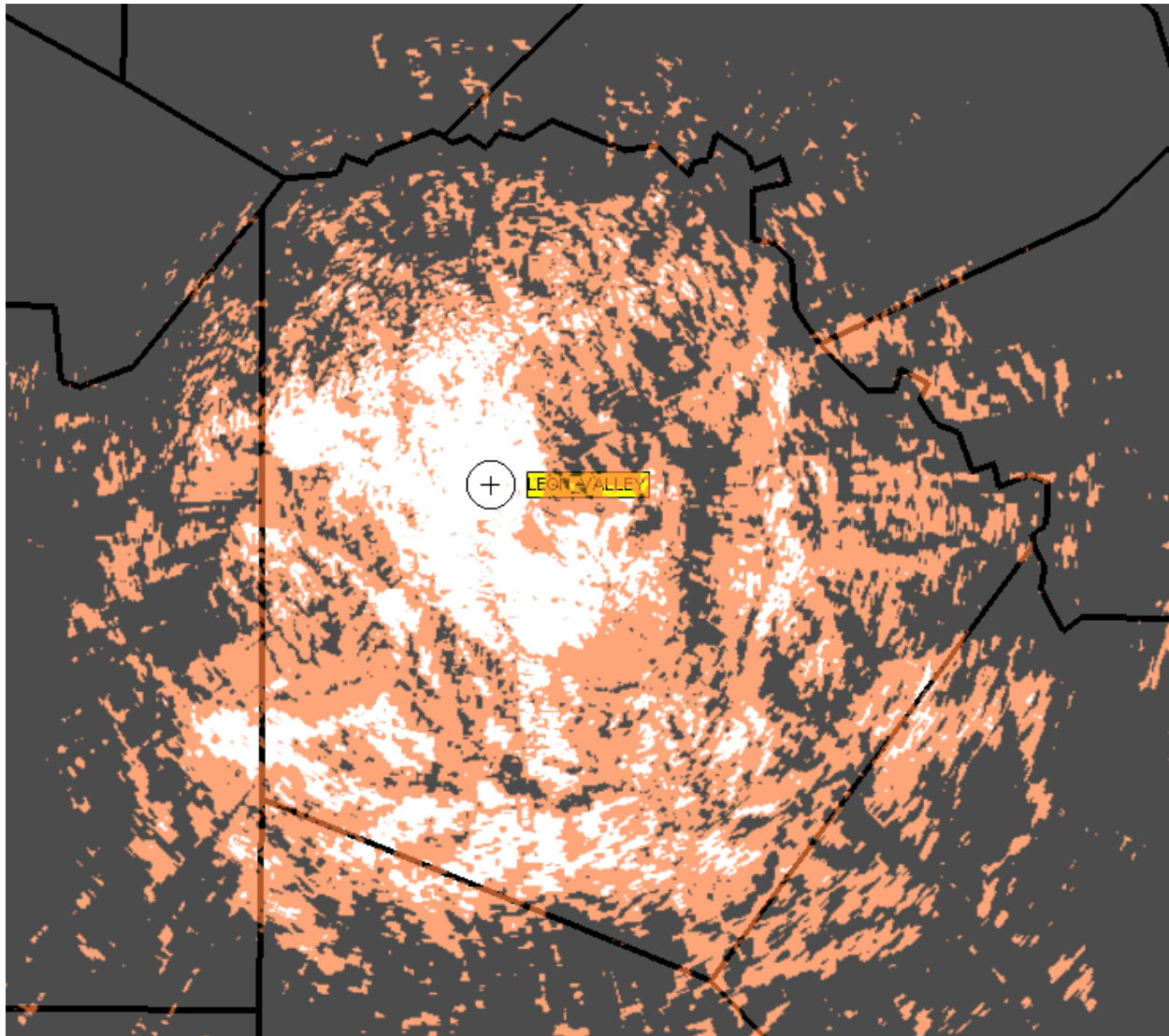


Figure 48 – Leon Valley Radio Coverage

Predicted coverage on the Leon Valley radio system is adequate within the Leon Valley area. Coverage extends to the south, north, and west, but is limited east toward San Antonio.

5.3.10.9 Future Plans

Immediate plans for Leon Valley include narrowbanding the system. Repeater equipment and subscriber radios are primarily narrowband capable. Only two subscriber radios are not capable of narrowband operation. The primary narrowbanding requirement will be the reprogramming of VHF wideband equipment. Leon Valley has long-term goals to upgrade to a P25 platform and implement a mobile data solution; however, no steps have been taken thus far to implement these plans.

5.3.10.10 Past Expenditures

Leon Valley provided the following past radio expenditures:

Table 77 – Leon Valley Past Radio Expenditures

Year	Project Description	Total Cost	Funding Source
2008	Replacement of FD repeater system	\$13,000	Local budget
Total		\$13,000	

5.3.10.11 Future Funding

Leon Valley did not identify future funding opportunities.

5.3.10.12 Assessment

VHF Operation—Leon Valley is one of the few agencies within Bexar County who have not migrated or do not have plans to migrate to the COSA/Bexar County 800 MHz system. While Leon Valley has developed solutions to communicate with primary interoperability partners, connectivity with users on the COSA/Bexar County system is limited to a single patched channel. Coverage on the VHF repeater system is adequate within the Leon Valley area, but will quickly drop off outside of the City, especially toward the east.

Non-public safety-grade Radios—Subscriber radios utilized by Leon Valley are analog-only radios that are not designed with the durability and reliability requirements for public safety operation. These radios suffer from a higher failure rate compared to public safety-grade radios and are not recommended for public safety operation.

P25—It is the State's goal that P25 systems be implemented across the state by 2015. Leon Valley indicated a desire to migrate toward a P25 platform. None of the present radio equipment utilized by Leon Valley is P25 capable and will require replacement in order for Leon Valley to become P25 compliant.

Narrowbanding—While most radio equipment is narrowband capable, significant efforts are still needed to reprogram Leon Valley radios in the narrowband mode. Leon Valley has indicated plans to complete the reprogramming; however, no funding sources were identified for the programming efforts.

5.3.11 Radio System—Bexar County Fire Alarm

5.3.11.1 System Description

The Bexar County Fire Alarm system is a single site VHF wideband analog system utilizing one simplex channel and one mobile-only talkaround channel. The system is used by most VFDs within Bexar County. The primary transmitter is located on the Hy-Lions site, which provides coverage throughout the county. The primary channel is used for tone and voice paging, and the talkaround channel is used for on-scene fire ground operations.

The fixed infrastructure for the system is maintained by Bexar County, who also provides dispatch services. Subscriber equipment is maintained by the individual VFDs. The fixed infrastructure is narrowband capable. An

accurate subscriber inventory is not available; however, it is estimated that approximately one-third of the subscriber radios on the Fire Alarm system are not narrowband capable.

5.3.11.2 User Agencies

Agencies/entities that utilize the Bexar County Fire Alarm radio system were not provided.

5.3.11.3 Dispatch Facilities

Bexar County Fire Alarm is dispatched by Bexar County. A single Harris Maestro console position is assigned for dispatch operation. Tone and voice paging is the primary means of dispatch. All dispatch transmissions are sent from the Hy-Lions radio site. Bexar County directly receives most 9-1-1 calls that require response on the system; however, several agencies maintain their own PSAP and must send a request to Bexar County to send out tone and voice paging requests.

The Fire Alarm simplex channels are hard-patched to talk groups on the COSA/Bexar County 800 MHz EDACS system. The patch permits connectivity between VHF and 800 MHz primary agencies. However, the patch is not effective when VHF primary users are out of range from the primary transmitter location.

Channels appearing on the console include:

Table 78 – Fire Alarm Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Fire Alarm 1	Fire Alarm Dispatch
Fire Alarm 3	Fire Alarm fire ground

5.3.11.4 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions with Bexar County regarding the Fire Alarm system:

- The system suffers from limited coverage as only one transmitter site is utilized.
- The system utilizes a simplex channel, limiting user-to-user communication.
- Narrowbanding will be a major challenge for many agencies utilizing the system due to funding limitations. Bexar County plans to leave the repeater programmed in the wideband mode to permit communications by user agencies that have not narrowbanded their equipment following the 2013 deadline.

5.3.11.5 Radio Sites

Refer to the COSA/Bexar County system for additional information regarding the Hy-Lions site.

5.3.11.6 Radio Inventory

Bexar County provided the following radio equipment information.

Table 79 – Bexar County Fire Alarm Fixed Radio Equipment

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
Hy-Lions	Base Station	Harris	MASTRIII	154.2500 (TX/RX) 156.7 Hz (CTCSS)
Hy-Lions	Base Station	Harris	MASTRIII	153.7700 (TX/RX) 156.7 Hz (CTCSS)

5.3.11.7 FCC Licenses

Table 80 – Bexar County FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
KKW980	1	29-23-12.5	98-26-11.5	153.7700 154.2500	FB	123.9	82	287	20K0F3E
	2	BEXAR COUNTY, TX		153.7700 154.2500	MO		110	110	20K0F3E

KKW980—Call sign KKW980 is licensed by Bexar County and covers the primary operations on the two Bexar County Fire Alarm simplex channels.

The license reflects wideband operation; however, an application is currently pending to add narrowband analog emissions.

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5.3.11.8 System Coverage

Serious coverage problems were reported on the Fire Alarm system.

The following coverage map depicts the predicted “talk out” portable coverage for the Fire Alarm radio system. Coverage thresholds are based on TSB-88 criteria for wideband analog VHF systems. All antennas were assumed to be omni-directional. Antenna heights and ERP values were gathered from FCC licenses. In the following map, white indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

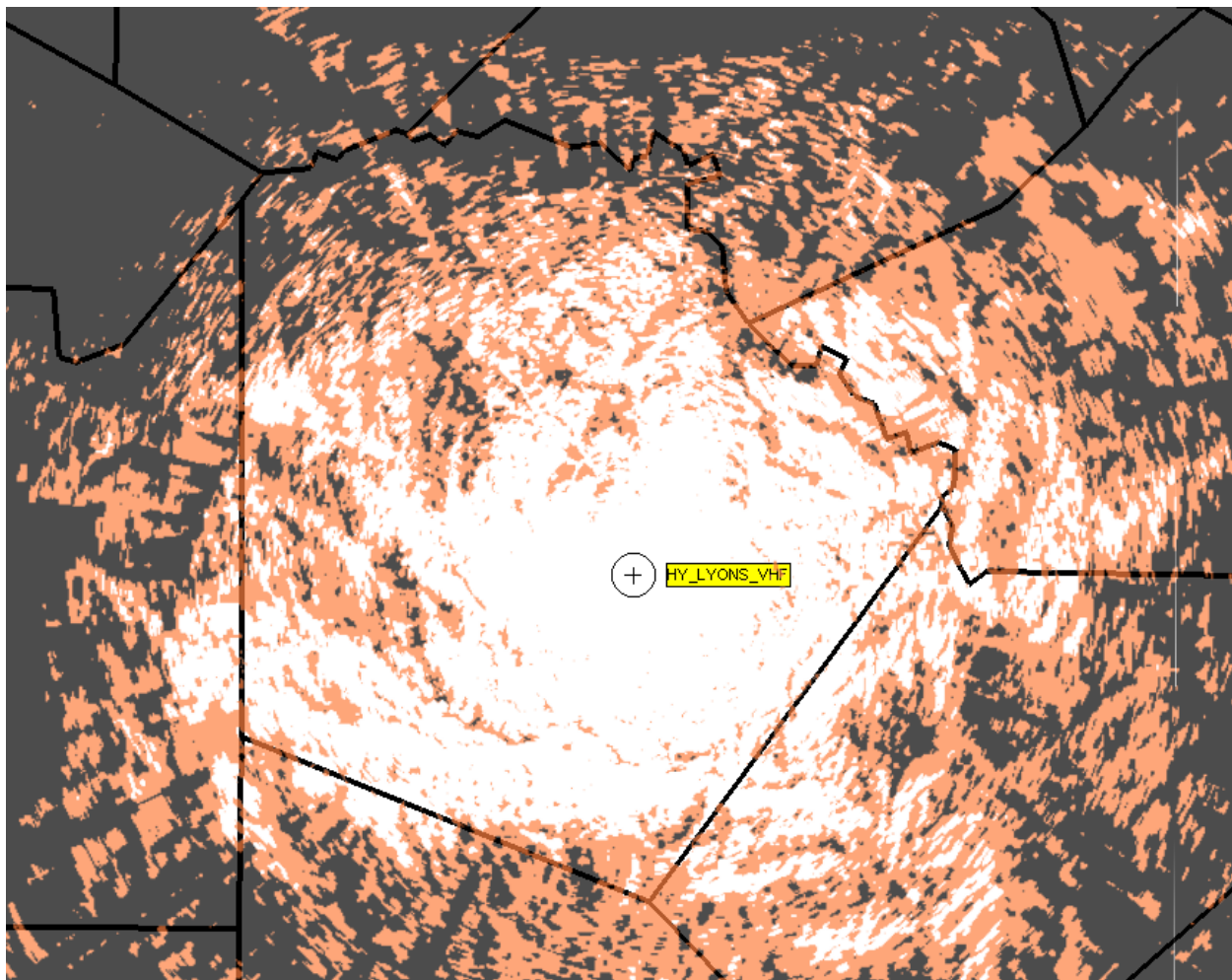


Figure 49 – Predicted Radio Coverage for Hy-Lions Site

Propagation analysis indicates that the Hy-Lions radio site provides excellent coverage throughout much of Bexar County. Coverage problems likely exist in the western portions of the county. Coverage is extremely limited along

the northern county border. Because the transmitter is a simplex base station, unit-to-unit communication will be limited to localized areas.

5.3.11.9 Future Plans

Bexar County plans to maintain the Fire Alarm base stations in a wideband mode to permit continued operability for user agencies in the event that they have not fully upgraded their equipment. Because subscriber equipment is owned and controlled by the local VFDs, narrowbanding of this equipment is out of the control of Bexar County.

Bexar County has the desire to ultimately upgrade all VHF primary VFDs with 800 MHz radios that will operate on the trunked EDACS system. In the interim, Bexar County would like to implement a VHF conventional simulcast system that will provide repeater capability with enhanced VHF coverage throughout Bexar County. No firm plans have been indicated for 800 MHz upgrades or the VHF infrastructure expansion.

5.3.11.10 Past Expenditures

No past expenditures were provided by users on the Fire Alarm system.

5.3.11.11 Future Funding

No future funding sources were identified by users on the Fire Alarm system.

5.3.11.12 Assessment

Coverage—Radio coverage on the Fire Alarm system is provided by a single radio site. While the radio site provides good coverage throughout much of Bexar County, major coverage gaps exist. Coverage gaps are the most prominent in the western and northern portions of the county. Because the transmitter is utilized for dispatch paging, volunteers who are out of range will not receive dispatch pages. Unit-to-unit simplex operation is the primary means of incident response, and thus radio coverage is a reflection of connectivity from the dispatch center to the radio users. When out of range from the transmitter location, radio users will not have access to the hard-patch to the 800 MHz trunked system. This inhibits the ability of VHF primary first responders to communicate with 800 MHz primary users. A countywide VHF infrastructure would dramatically improve VHF radio coverage on the system.

Capacity—The Fire Alarm system provides severely restricted capacity as only one channel is available for tactical operations. Because the channel is a simplex channel, it is very difficult to manage simultaneous events. Agencies coordinating multiple events have a very high likelihood of interfering with each other. VHF interoperability channels such as TXFIRE1, 2, and 3 may be used to supplement capacity on the Fire Alarm channel. However, primary response is not the intended use of the interoperability channels. The Fire Alarm system covers far more users than the two simplex channels can be expected to support.

Simplex Operation—The use of simplex channels as opposed to repeaters severely restricts the ability of radio users to coordinate with radio users outside of the immediate area of an event. Messages must be relayed through the dispatcher if users are out of range. Simplex operation is typically acceptable for localized fire ground events.

Narrowbanding—Narrowbanding is a major concern for users on the Fire Alarm system. It is already anticipated that user agencies will not meet the narrowbanding deadline due to funding limitations. The plans to leave the base station receiver in a wideband mode is an interim solution, but is not ideal as wideband to narrowband

communications may result in distorted communication. No plans are in place to replace the remaining wideband-only subscriber radios on the system or to reprogram narrowband capable radios in the narrowband mode.

P25—It is the State's goal that P25 systems be implemented across the state by 2015. Users on the Fire Alarm system will have a major challenge meeting the narrowbanding deadline, let alone upgrading to P25.

Interoperability—Interoperability on the Fire Alarm system is achieved through a hard-patch to the 800 MHz trunked system. However, users out of range from the Hy-Lions site will not have access to the patch and will thus lose connectivity with 800 MHz users without a localized mobile gateway. Unit-to-unit connectivity is not available between subscriber radios in different frequency bands and is thus dependent on overlapping coverage on patched channels.

Non-public Safety-grade Radios—Equipment utilized by VFD agencies within Bexar County is primarily analog-only equipment that is not designed for public safety operation. These radios are not constructed with the durability and reliability requirements needed for public safety operation, and are thus not recommended by L.R. Kimball. However, L.R. Kimball recognizes that VFDs within Bexar County will likely not have sufficient funding to meet the narrowbanding deadline, let alone purchase public safety-grade radios.

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5.4 Comal County

Comal County, with an estimated 2009 population of 114,525, is located in the eastern portion of the AACOG. The county is 575 square miles, of which 13 square miles is water. The county is comprised of various cities, such as Bulverde and New Braunfels and unincorporated areas, such as Bracken and Spring Branch.

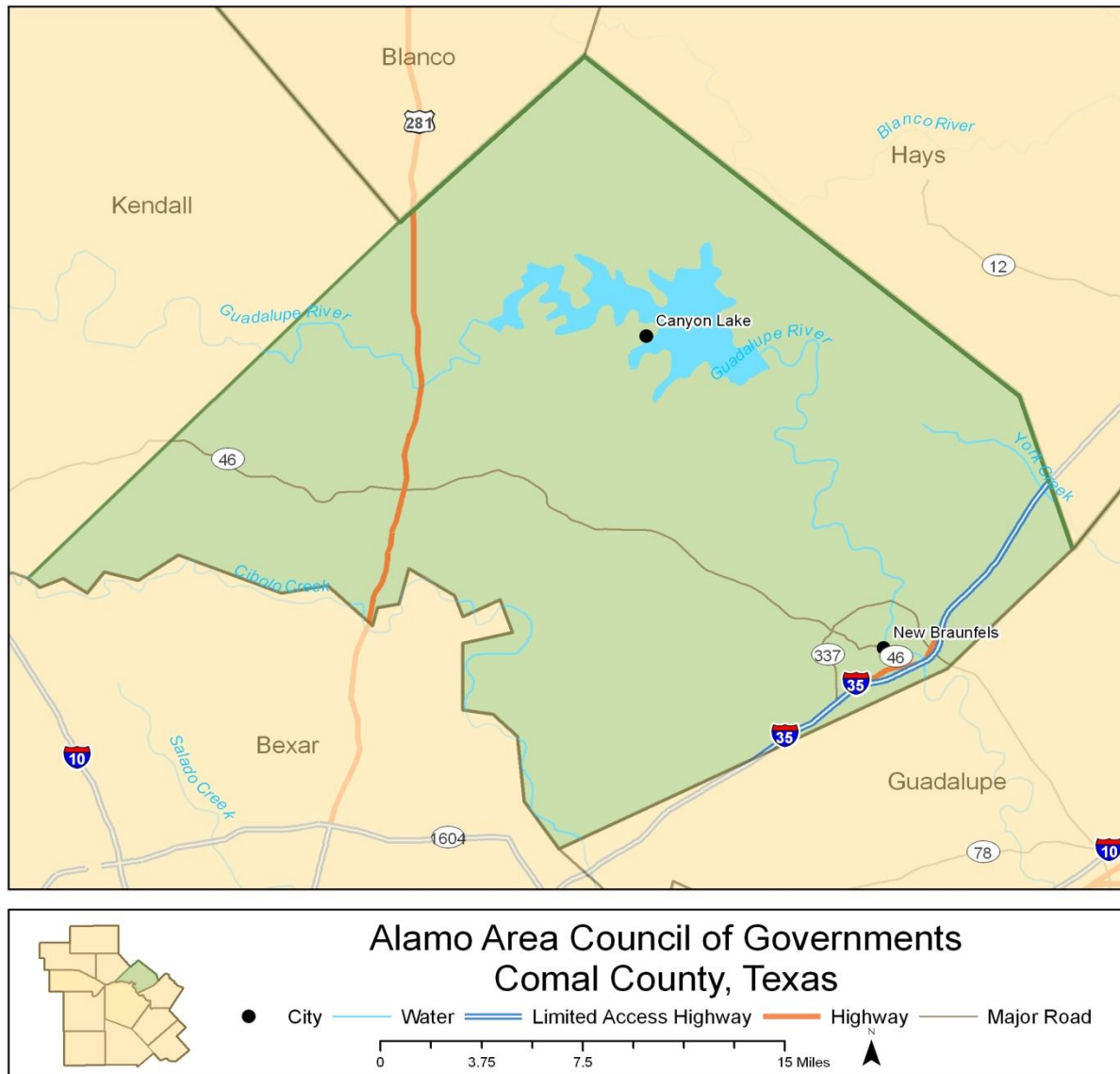


Figure 50 – Comal County

Through the interview and assessment process, L.R. Kimball found that radio systems within Comal County include the Comal County radio systems, using conventional base stations with voted repeaters, and the New Braunfels radio system, operating on the 900 MHz LCRA EDACS system. New Braunfels operates supplemental P25 VHF conventional repeaters for interoperability purposes. The Comal County radio system provides service for law enforcement, fire/EMS, and Road and Bridge throughout the county. The New Braunfels radio system provides service for the New Braunfels PD and New Braunfels FD.

5.4.1 Radio System—Comal County

5.4.1.1 System Description

The Comal County radio system is split between multiple conventional VHF repeaters for law enforcement and fire/EMS operations. The law enforcement users on the radio system utilize two primary repeater sites: channel one covering the southern section of the county and channel two covering the northern section of the county, including the Bulverde PD. Remote receivers are utilized to vote audio to improve “talk back” coverage throughout the county. Microwave links are utilized for backhaul on the voted receiver system. Primary law enforcement frequencies are utilized both for dispatch and tactical operations.

Fire/EMS users on the radio system utilize multiple VFD-controlled repeaters that are separately licensed by each VFD. Each repeater frequency is used for tactical operations for the operating FD. Dispatch for each station is provided at the Comal County PSAP. Grant funding has been secured to upgrade the VFD repeaters to P25 VHF conventional along with the Road and Bridge repeater. All law enforcement repeaters are currently operating in the P25 conventional mode.

Subscriber and base station equipment throughout the county is narrowband capable and operates in the P25 mode for law enforcement and in the narrowband analog mode for VFDs and Road and Bridge. All law enforcement and road and bridge radios are P25 conventional capable and all FDs have a mix of P25 and non-P25 radios.

5.4.1.2 User Agencies

The following agencies/entities utilize the Comal County radio system.

Table 81 – Comal County User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Comal County SO	Law Enforcement	James Miller	830-620-3400	soajrm@co.comal.tx.us
Comal County Jail	Law Enforcement	James Miller	830-620-3400	soajrm@co.comal.tx.us
Bracken FD	Fire	Bill Anz	210-838-6052	txarsoncop@sbcglobal.net
Bulverde Area FD	Fire	Brian Box	210-825-3875	bavfd@gvtc.com
Comal County Constables	Police	James Miller	830-620-3400	soajrm@co.comal.tx.us
Bulverde-Spring Branch EMS	EMS	Scott Wilkinson	210-241-1701	swilkinson@bsbems.org
Garden Ridge PD	Law Enforcement	Gary Johnson	210-651-6441	police@ci.garden-ridge.tx.us

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Spring Branch VFD	Fire	Dustin Beaudoin	830-515-3481	dbeaudoin.esd4@yahoo.com
Bulverde PD	Law Enforcement	Gary Haecker	830-438-3612	Haeckerg@el.bulverde.tx.us
Canyon Lake FD	Fire	Shawn Wherry	830-907-2922	Chief500@gvtc.com
Comal County Road and Bridge	Public Works	Carol Edgett	830-221-1108	cctcje@co.comal.tx.us

As stated, agency users on the system are split between law enforcement, road and bridge, and fire/EMS.

The Comal SO has primary law enforcement jurisdiction throughout Comal County, outside incorporated cities with their own PDs. Coverage requirements for the SO are primarily mobile and outdoor portable; however, indoor coverage is required occasionally. Personnel are dispatched directly from their vehicles on the SO primary dispatch channel or the Tarpley repeater. Coverage is limited in portions of the county that lie within the primary response areas of the SO.

Garden Ridge and Bulverde PDs have primary jurisdictions throughout the incorporated city borders. Coverage requirements are primarily mobile and outdoor portable; however, indoor coverage is required occasionally. Coverage provided by the primary SO system is generally adequate for Garden Ridge and Bulverde.

Fire/EMS users are dispatched based upon fire districts assigned to each VFD. Communications are maintained between the dispatch center and the VFDs via control stations located at each VFD. Paging is used as the primary method to contact volunteers. No coverage problems were indicated on the paging system. The coverage requirement for fire/EMS users is indoor portable. To supplement coverage on the fire/EMS dispatch channel, VFD fire repeaters are used for on-scene response. When coverage is insufficient on repeated channels or when multiple incidents occur at one time, traffic is off-loaded to a simplex talkaround channel, typically TXFIRE1.

5.4.1.3 Dispatch Facilities

The Comal County PSAP, located at the Comal County SO, serves as the primary dispatch center for the Comal County radio system.

The center includes a total of five Motorola MCC5500 consoles, four located at operator positions and one located at the supervisor's position. RF control stations are used to interface the dispatch consoles with the remote repeater sites. Control stations are connected to yagi antennas on the roof of the dispatch center that point toward the various repeater sites. The consoles provide the capability to patch multiple channels that appear on the console screen, allowing traffic from one channel to be repeated on another channel. Traffic from the New Braunfels 900 MHz EDACS system can be linked to the Comal County consoles through a gateway device.

5.4.1.4 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

Coverage—While coverage on the system was not deemed to be a major problem, it was indicated that additional repeater sites would be needed.

Interoperability— While information provided by Comal County indicated that the County and New Braunfels could be connected through a patch, user feedback indicated that the primary means of cross-agency communications was through the use of multiple radios – one on VHF and one on 900 MHz. This method of communication has proven to be operationally ineffective. Interoperability has been enhanced through the implementation of three VHF conventional channels on the New Braunfels system, which are used for interoperability purposes with Comal County and other VHF P25 primary agencies.

5.4.1.5 Radio Sites

Comal County provided the following radio site information:

Table 82 – Comal County Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Kerlick Tower	New Braunfels	New Braunfels Utilities	Unknown	No
River Road Tower	Canyon Lake Area	Prive	Unknown	Unknown (leased)
Startz Hill Tower	Startzville Area	Energy Transfer	Unknown	Unknown
Devils Hill Tower	Bulverde Area	Moya Communications	Unknown	Unknown (lease)
Garden Ridge Tower	Garden Ridge	City of Garden Ridge	Unknown	Unknown (City property)

5.4.1.6 Radio Inventory

Comal County provided the following radio equipment information:

Table 83 – Comal County Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Comal County	Motorola	XTL2500	Mobile	154
	Motorola	XTS2500	Portable	188
	Motorola	XTL1500	Mobile	48
	Motorola	XTS1500	Portable	10
	Motorola	Astro Spectra Plus	Mobile	3
	Motorola	HT1250	Portable	10
	Motorola	CDM1250	Portable	2
	Harris	900 MHz EDACS	Mobile	1
	Motorola	800 MHz	Mobile	1
	Motorola	UHF	Mobile	1

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Bracken VFD	Motorola	HT1000	Portable	7
	Motorola	XTS5000	Portable	10
	Motorola	XTL2500	Mobile	11
Bulverde VFD	Motorola	HT1000	Portable	20
	Motorola	XTS5000	Portable	10
	Motorola	XTL2500	Mobile	8
Spring Branch EMS	Motorola	XTS5000	Portable	2
	Motorola	HT1000	Portable	18
	Motorola	XTL2500	Mobile	4
	Motorola	CDM1550LS	Mobile	1
	Motorola	CDM1550	Mobile	1
	Motorola	MaxTrac	Mobile	2
Spring Branch Fire	Motorola	MTX2000	Portable	5
	Motorola	HT1000	Portable	1
	Motorola	HT1250	Portable	5
	Motorola	CDM1250	Mobile	6
	Motorola	MAXTRAC	Mobile	4
Canyon Lake Fire/EMS	Motorola	XTS5000	Portable	15
	Puxing	PX777	Portable	10
	Motorola	XTL2500	Mobile	10
	Motorola	CDM1250	Mobile	4
	Motorola	XTL2500	Control Station	2
	Motorola	XTL5000	Control Station	1
Total Portables				313
Total Mobiles				259
Total Control Stations				3
Total				575

5.4.1.7 FCC Licenses

Table 84 – Comal County FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
KVF679	1	29-42-30.8	98-9-40	155.5950	FB2	91	300	600	11K0F3E 16K0F3E 20K0F3E 8K10F1D

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
									8K10F1E
	2	29-40-47.8	98-8-57	153.9650 154.7100 155.3700 153.8300 159.1500	FX1 FX1 FB FX1 FX1	46 46 46 49 40	110 110 110 50 45	190 190 110 245 90	11K0F3E 16K0F3E 20K0F3E 8K10F1D 8K10F1E
	3	29-48-34.8	98-26-45.1	156.0000	FB2	55	300	600	11K0F3E 16K0F3E 20K0F3E 8K10F1D 8K10F1E
	5	Comal County, TX		153.9650 154.7100 154.9500 156.0000 159.1500 153.8300	MO		110		11K0F3E 16K0F3E 20K0F3E 8K10F1D 8K10F1E
	6	29-49-16.8	98-17-41	154.2950	FB2	60	350	750	11K0F3E 16K0F3E 20K0F1E 20K0F3E 8K10F1D 8K10F1E
	1	29-49-56.8	98-17-25	155.8800	FB2	97	110	93	11K0F3E 16K0F3E 20K0F1E 20K0F3E 8K10F1D 8K10F1E
	2	29-44-24.8	98-12-36	153.8150	FX1	8	25	38	11K0F3E 16K0F3E 20K0F1E 20K0F3E 8K10F1D 8K10F1E
	3	40 km around location 1		153.8150 155.8800	MO		110 110	110 100	11K0F3E 16K0F3E 20K0F1E 20K0F3E 8K10F1D 8K10F1E
	4	3 km around 29-40-47.8	98-8-57	453.0875 458.0875	MO		2 2	2 2	11K0F3E 16K0F3E 20K0F1E 20K0F3E 8K10F1D
WPRI300									

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
									8K10F1E
KZT493	1	29-38-21	98-17-54	154.4450	FB2	15	50	105	11K2F3E 20K0F3E
	2	6.1 m control stations, TX		153.8900	FX1		50	50	11K2F3E 20K0F3E
	3	40 km around location 1		153.8900	MO		45	45	11K2F3E 20K0F3E
KNED326	1	6.1 m control stations, TX		154.2500	FX1		35	35	11K2F3E 20K0F3E 8K10F1D 8K10F1E
	2	29-46-17.8	98-27-13.1	154.2800	FB2	58	100	114	11K2F3E 20K0F3E 8K10F1D 8K10F1E
	3	48 km around location 2		154.2500 155.9250	MO		35	35	11K2F3E 20K0F3E 8K10F1D 8K10F1E
WPKH510	1	29-56-54.8	98-21-1.1	154.2050	FB2	37	45	55	20K0F1D 20K0F3E
	2	6.1 m control stations, TX		156.0450	FX1		15		20K0F1D 20K0F3E
	3	16 km around location 1		154.2050 156.0450	MO		45		20K0F1D 20K0F3E
WPFC267	1	29-49-56.8	98-17-25	151.2500	FB2	91	50	100	20K0F3E 20K0F3E 11K0F3E 16K0F3E 8K10F1D 8K10F1E
	2	6.1 m control stations, TX		153.9500	FX1		50		20K0F3E 11K0F3E 16K0F3E 8K10F1D 8K10F1E
	3	40 km around location 1		151.2500 153.9500	MO		100		20K0F3E 11K0F3E 16K0F3E 8K10F1D 8K10F1E

KVF679—Call sign KVF679 covers primary operations for the Comal County SO. The license covers operation of two repeaters covering the northern and southern portions of the county. Control stations and simplex stations are licensed at location 2 (shown above), the Comal County dispatch center. A third repeater site is located in the center of the county and is licensed at location 6 (shown above). The license covers mobile operation of TXLAW1 and simplex operation of TXLAW2 at the dispatch center. Wideband, narrowband and P25 emissions have been added to the license. The repeater frequency 156.0000 MHz is licensed on a secondary, non-interference basis.

WPRI300—Call sign WPRI300 covers mobile simplex operation for the Comal County Jail in the UHF band and a VHF repeater for Comal County Road and Bridge. The frequency 155.8800 MHz requires the addition of the narrowband emission designator 11K0F3E.

KZT493—Call Sign KZT493 covers repeater operation for frequencies 154.4450 MHz (TX) and 153.8900 MHz (RX). The station is operated by Bracken FD. The station covers operation of control stations, but does not cover mobile-to-mobile simplex. The license is up-to-date and includes narrowband emissions.

KNET326—Call sign KNET326 covers repeater operation for the frequencies 154.2800 MHz (TX) and 154.2500 MHz (RX). The station is used by the Bulverde Area FD. The repeater TX frequency 154.2800 MHz is the Texas common channel TXFIRE1 and, per the Texas channel plan, should only be implemented in a simplex mode. The license includes narrowband emissions.

WPKH510—Call sign WPKH510 covers repeater operation for the frequencies 154.2050 MHz (TX) and 156.0450 MHz (RX). The station is operated by the Spring Branch VFD and Bulverde-Spring Branch EMS. Control station and talkaround operation is covered. The license only covers wideband operation. Narrowband emission designators need to be added prior to January 1, 2013 to demonstrate narrowbanding compliance.

WPFC267—Call sign WPFC267 covers repeater operation for the frequencies 151.2500 MHz (TX) and 153.9500 MHz (RX). The station is operated by the Canyon Lake FD. Control station and talkaround operation is covered. The license only covers wideband operation. Narrowband emission designators need to be added prior to January 1, 2013 to demonstrate narrowbanding compliance.

5.4.1.8 System Coverage

L.R. Kimball found that coverage was not indicated to be a problem with the Comal County radio systems.

The following predicted coverage map depicts the predicted “talk out” portable coverage for the Comal County law enforcement portion of the Comal County radio system. The map displays the strongest signal strength from all conventional tower sites. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

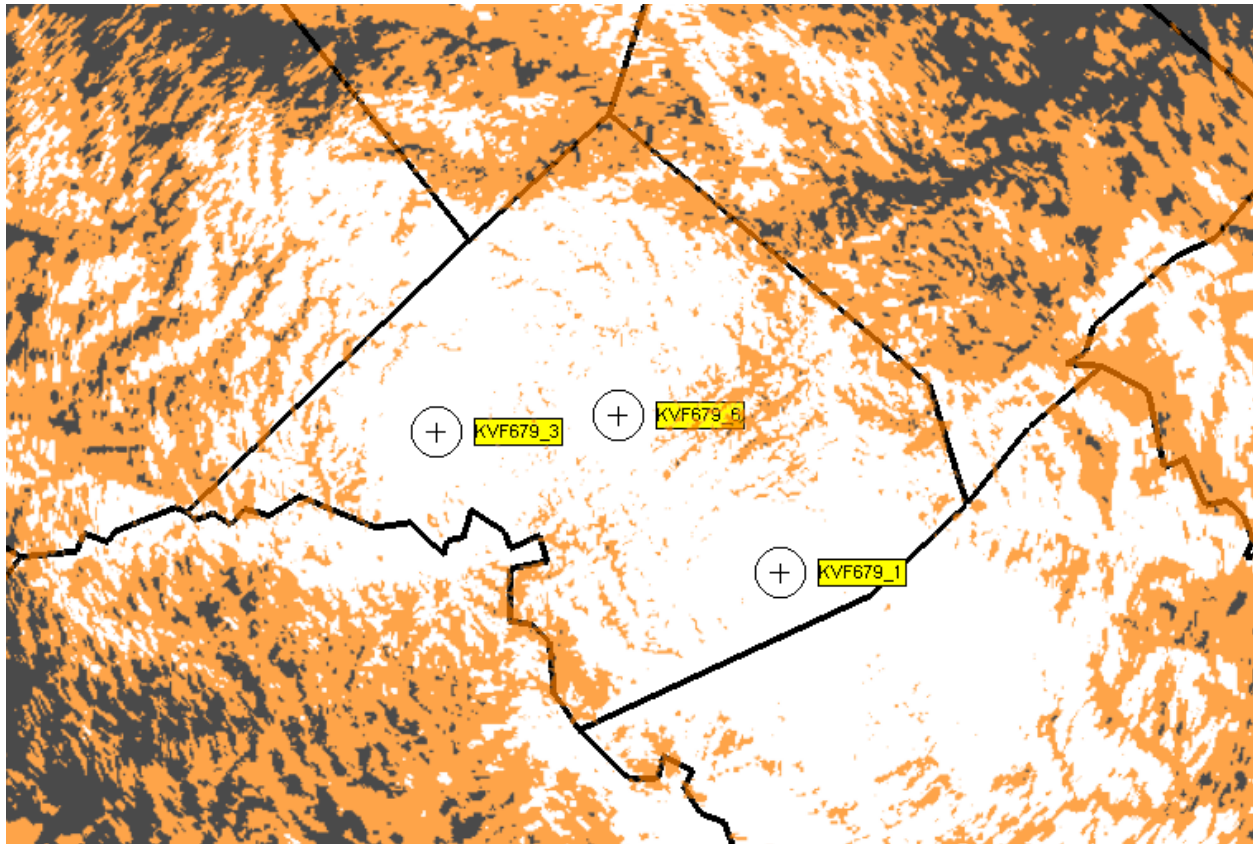


Figure 51 – Predicted Radio Coverage for Comal County Law Enforcement

L.R. Kimball found that when comparing the predicted coverage map to Comal County law enforcement feedback, results are synonymous. Coverage throughout Comal County on the three conventional stations covered under call sign KVF679 appears to be satisfactory. L.R. Kimball notes that studies were calculated based on the licensed ERPs. The listed ERP on call sign KVF679 is 600 watts, which is not realistic for typical transmission systems.

Coverage on the fire/EMS portion of the Comal County radio system was indicated to be a concern by VFDs within Comal County.

User reported coverage is as follows:

Table 85 – Comal County User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	89%
Portable coverage	85%
In-building coverage	80%

The following predicted coverage map depicts the predicted “talk out” portable coverage for the Comal County network of fire/EMS repeaters. The map displays the strongest signal strength from all conventional tower sites. White indicated satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

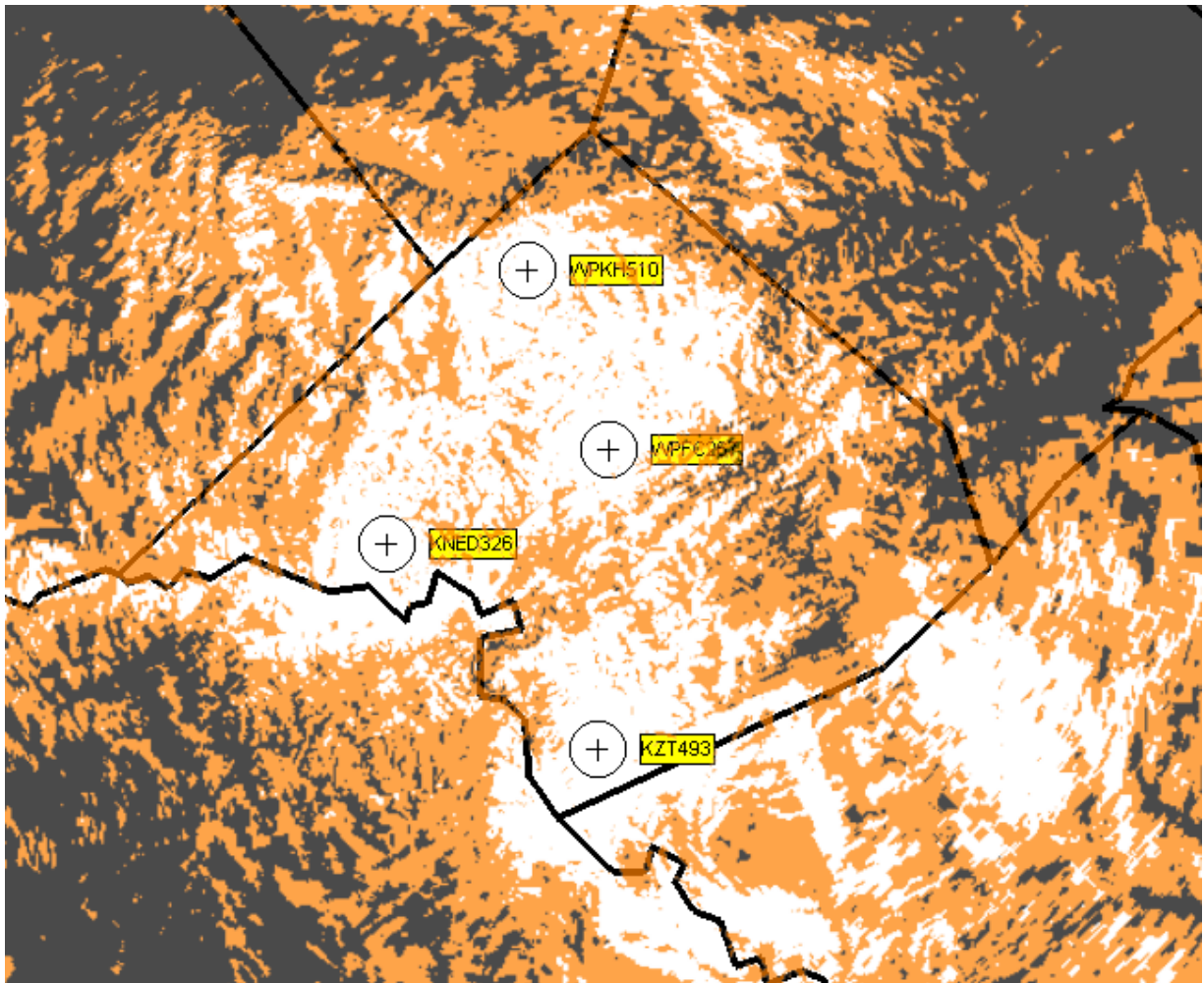


Figure 52 – Predicted Radio Coverage for Comal County Fire/EMS

When compared to assessment feedback, the predicted coverage map is nearly identical. Portable coverage is limited in portions of the county, particularly on the eastern portion of the county. Using the existing sites, an additional tower site is likely needed. Co-locating the fire repeaters at the same sites as the law enforcement system would provide better coverage than what is currently being provided.

5.4.1.9 Future Plans

Comal County indicated the following future plans:

New Computer Aided Dispatch (CAD) System—The County indicated the desire to install a new CAD system; grant funding has been secured for this project. The CAD system has been implemented since the initial data collection period.

Mobile CAD System—The County indicated the desire to install a mobile CAD system to supplement the primary CAD system. The County has secured grant funding and is currently installing and implementing the system with a target completion date of March 31, 2011.

Voting Receiver—An additional voting receiver for the SO2 channel is in the process of being added to the network. The receive site will be located on a prospective lease tower site in the Rebecca Creek area on the north side of Comal County. Grant funding has been secured for the project.

Microwave Network—The County indicated the desire to utilize the existing microwave network used for radio backhaul for the voted receivers for data applications. No further plans have been implemented to explore this opportunity.

Countywide Trunking—The County indicated the desire to operate a countywide trunking system in the future. This item was indicated as a “wish list” goal as funding for such a project is not immediately available.

5.4.1.10 Past Expenditures

Comal County provided the following past radio expenditures:

Table 86 – Comal County Past Radio Expenditures

Year	Project Description	Total Cost	Funding Source
2010	Digital upgrade	\$32,000.00	Bracken VFD
2009	Digital upgrade	\$32,000.00	Bracken VFD
2009	Digital Migration (Canyon Lake)	\$50,857.26	Ad Valorem Revenue
2010	Tower Lease (Canyon Lake)	\$795.36	
2010	CAD system	\$254,043	UASI
Total		\$369,695	

5.4.1.11 Future Funding

Comal County identified the following future funding opportunities:

Table 87 – Comal County Future Funding

Funding Source	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Texas										

Funding Source	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PSIC	\$117,000									
IECGP										
AFG										
DHS	\$434,753									
Other	\$82,000									
Region										
Total	\$633,753									
Total									\$633,753	

5.4.1.12 Assessment

Interoperability—Comal County indicated a limited ability to communicate with the 900 MHz users in New Braunfels and 800 MHz users on the Live Oak and San Antonio systems. While documentation indicates that the New Braunfels and Comal County systems can be interfaced through a gateway device, this was not indicated to be common practice. 800 MHz channels are integrated on the WAIS system, which is operational in Comal County. UHF, 800 MHz, and 900 MHz connectivity is available in a mobile gateway located in a deployable trailer. L.R. Kimball notes that radio coverage provided by the WAIS system is limited to the available antenna height at the Comal County dispatch center. This limits 800 MHz connectivity to simplex operation. In the event of a major disaster within Comal County, it is likely that 800 MHz users from Bexar County or the Live Oak area will respond. The current methods of connectivity provide limited coverage or require deployable resources which only provide coverage within a localized area.

Conventional Operation—Conventional operation places inherent limitations on the operation of a radio system. Since Comal County cannot be covered by a single repeater site, multiple conventional repeaters are necessary. This limits users on opposite sides of the county from communicating directly with each other without the use of a console patch and requires dispatchers to monitor and dispatch multiple channels. Users must consciously switch channels when roaming throughout the county from the coverage area of one site into the area of another.

P25 Operation—User inventories indicated that most radios on the Comal County system are VHF conventional capable; however, inventories for VFDs indicate a number of non-P25 radios are still being utilized. This creates an operability concern in the event that fire users without P25 radios have the need to access the P25 law enforcement channel or P25 repeaters in adjacent jurisdictions. This problem is partially alleviated by the fact that all FDs maintain a stock of some P25 radios, including XTL2500 model mobiles in the primary trucks. Plans are in place to migrate all VFDs to P25 operation by 2013.

5.4.2 Radio System—City of New Braunfels

5.4.2.1 System Description

L.R. Kimball found that the New Braunfels PD and FD operate as tenants on the LCRA 900 MHz EDACS system. The LCRA system provides radio coverage throughout 61 counties in southeast Texas. Spare capacity on the

system has allowed LCRA to lease usage on the system to public safety agencies on a cost recovery basis. The system is owned, constructed and maintained by LCRA.

A total of four LCRA radio sites contribute to coverage in the New Braunfels area. The sites are arranged in a multi-cast configuration, with different frequencies at each site. Channel capacity at each site ranges from 5 to 12 frequencies. The system provides approximately 95 percent mobile and portable coverage in the New Braunfels area and approximately 90 percent in-building coverage.

Plans are underway to upgrade the 900 MHz EDACS system to Harris OpenSky, which will require New Braunfels to migrate their subscribers to a new system before the current EDACS system is decommissioned. The switch has been purchased and installed and is currently interfaced with the present EDACS system. The system will be fully cut over to OpenSky in the next three to four years. LCRA has purchased a Harris VIDA switch and is implementing a 700 MHz P25 overlay, utilizing the LCRA backbone infrastructure. This system will be used exclusively by public safety users and capital costs for the implementation of P25 equipment must be covered by public safety agencies. Virtually all New Braunfels radios must be replaced prior to the decommissioning of the LCRA EDACS system. LCRA desires to migrate primary operations to the LCRA 700 MHz system that is currently operational in the New Braunfels area.

Between New Braunfels PD and FD users, 21 talk groups have been assigned for New Braunfels primary operations. Additional talk groups are programmed in the New Braunfels radios with interfaces to system-wide interoperability channels, Bexar County interoperability talk groups, and VHF common channels.

New Braunfels has implemented three P25 capable VHF conventional repeaters, which are gateway connected to the 900 MHz LCRA system. The channels are used for interoperability primarily between New Braunfels and Comal County. The channels are operating in the analog mode and may be used for interoperability purposes with any VHF primary agencies.

5.4.2.2 User Agencies

The following agencies/entities utilize the New Braunfels radio system:

Table 88 – New Braunfels User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
New Braunfels PD	Law Enforcement	Lt. Michael Penshorn	830.608.2179	mpenshorn@nbtexas.org
New Braunfels FD	Fire/EMS	Fire Chief, John Robinson	830.221.4207	jrobinson@nbtexas.org

The New Braunfels PD and FD are the primary first responders within New Braunfels, which is located along the borders of Comal and Guadalupe Counties. Coverage requirements for the PD are primarily mobile and outdoor portable; however, indoor coverage is required occasionally. Personnel are dispatched directly from their vehicles on

one of two dispatch talk groups. The city is divided into zones to determine which dispatch channel is used. During an event, the dispatcher will assign the incident to a specific tactical talk group. The New Braunfels PD maintains separate talk groups for narcotics, and special weapons and tactics (SWAT) operations.

The New Braunfels FD is dispatched on a single talk group. Events are assigned by the dispatcher to one of three tactical fire talk groups. EMS utilizes a single talk group for primary communications. Certain fire talk groups are permanently patched to VHF stations to communicate with neighboring VHF primary jurisdictions. The coverage requirement for fire users is indoor portable.

5.4.2.3 Dispatch Facilities

Dispatch operations take place at the New Braunfels PSAP. Dispatch consoles consist of four Harris C3 Maestro units that provide access to all New Braunfels talk groups. Channels appearing on the console include:

Table 89 – New Braunfels Dispatch Console Channels

Channel Names	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
New Braunfels Common 1	New Braunfels Common 1
New Braunfels Common 2	New Braunfels Common 2
New Braunfels EMS	New Braunfels EMS
NBF_ALL	New Braunfels FD ALL CALL
NBF_DSP	New Braunfels FD Fire 1 (Dispatch)
NB_FIRE2	New Braunfels FD Fire 2
NB_FIRE3	New Braunfels FD Fire 3
NB_PTCH1	New Braunfels FD Patch 1
NB_PTCH4	New Braunfels FD Patch 4
NB_PTCH5	New Braunfels FD Patch 4
NB_FIRE4	New Braunfels Fire 4
NB_PD_3	New Braunfels PD 3
NB_PD_4	New Braunfels PD 4
NB_CID	New Braunfels PD Criminal Investigations Division
NB_DSP_1	New Braunfels PD Dispatch 1
NB_DSP_2	New Braunfels PD Dispatch 2
NB_EVENT	New Braunfels PD Event
NB_NARC	New Braunfels PD Narcotics
NB_SWAT1	New Braunfels PD SWAT 1
NB_SWAT2	New Braunfels PD SWAT2
NB_PTCH2	Comal County SO interface
CCTXLAW1	Comal County TXLAW1

5.4.2.4 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

System Replacement—LCRA system will be transitioning to OpenSky within three to four years. After this transition takes place, many New Braunfels radios will no longer work on the system. New Braunfels would like to migrate to the 700 MHz overlay on the LCRA system. To do so would require the replacement of all subscriber radios and the purchase of 700 MHz infrastructure to be installed by LCRA on the existing tower sites. The estimated cost for this upgrade is \$3,000,000.

Interoperability—Interoperability is a major concern for New Braunfels on the LCRA system. Currently, patching is available to interface New Braunfels with Comal County. However, communications on this patch were not indicated to be seamless. Outside the Comal County patch, New Braunfels users do not have the ability to communicate with VHF users. Five talk groups on the LCRA system are patched to the COSA/Bexar County system; however, there are no 800 MHz trunking sites that provide coverage throughout New Braunfels and, therefore, the patch is ineffective should users from San Antonio have to respond to New Braunfels. Interoperability has been enhanced with Comal County through the implementation of three VHF repeaters that provide a coverage footprint in the New Braunfels area, which can better support patching connections.

SWAT operations have particularly posed a problem for joint response between New Braunfels and Comal County. User feedback indicated that there were as many as ten joint events where New Braunfels and Comal County were unable to communicate. To address the problem, New Braunfels has secured funding to purchase multi-band APX model radios that are capable of operating in the VHF band. The radios will be 700 MHz capable for use on the New Braunfels system once it has migrated to 700 MHz P25.

5.4.2.5 Radio Sites

New Braunfels provided the following radio site information:

Table 90 – New Braunfels Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
C211 New Braunfels Kerlick	608 Kerlick Lane New Braunfels, TX 78130	NBU		
S217 Comal	196 Fredericksburg Road New Braunfels, TX 78130	LCRA		
C237 San Marcos Radio	228 W. Sessom Drive San Marcos, TX 78666	Cell Tex		
C151 Kingsbury	500 Prairie Lea Road Kingsbury, TX 78638	LCRA		
New Braunfels VHF Repeaters	NBU water tower	NBU		

New Braunfels provided the following radio shelter information:

Table 91 – New Braunfels Radio Shelters

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
C211 New Braunfels Kerlick	16x10	Fiberglass	1996-2000	Y	Y
S217 Comal	28x12	Concrete	1996-2000	Y	Y
C237 San Marcos Radio	28x12	Concrete	1996-2000	Y	Y
C151 Kingsbury	28x12	Concrete	1996-2000	Y	Y
New Braunfels VHF Repeaters	Unknown	Unknown	Unknown	Unknown	Unknown

5.4.2.6 Radio Inventory

New Braunfels provided the following radio equipment information:

Table 92 – New Braunfels Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
New Braunfels PD	Ericsson	LPE Scan	Portable	79
	Ericsson	LPE System	Portable	37
	MA/COM	P5370	Portable	5
	Ericsson	Orion Scan	Mobile	100
	Ericsson	Orion System	Mobile	5
	Ericsson	Orion System	Control Station	4
	MA/COM	M5300 Scan	Mobile	8
	MA/COM	M5300 System	Mobile	7
	MA/COM	EDACS 500m	Mobile	2
New Braunfels FD	Ericsson	LPE Scan	Portable	44
	Ericsson	LPE System	Portable	9
	MA/COM	P5350	Portable	1
	MA/COM	P5370	Portable	4
	Ericsson	Orion Scan	Mobile	24
	Ericsson	Orion System	Mobile	1
	Ericsson	Orion Scan	Control Station	2
	Motorola	APX7000	Portable	13
	Motorola	XTL2500	Mobile	13
Total Portables				192

Total Mobiles	166
Total Control Stations	12
Total	370

5.4.2.7 FCC Licenses

Table 93 – New Braunfels FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
QA513		29-42-30.8	98-9-40	935.5000 936.4500 936.9000 937.4000 937.8875 938.1500 938.4000 939.4250 935.1750 936.9625 937.1375 937.4125 937.4500 937.7000 937.9125 937.9625 937.9875 938.1875 938.2500 939.4125	FB2C	91.4	100	500	11K0F1D 11K0F2D 11K0F3E
PZL933	1	29-45-48	98-18-2	935.2000 935.7000 936.7000 936.9500 937.2500 937.7250 939.9375	FB2C	96	100	500	11K0F1D 11K0F2D 11K0F3E
WPMI700		29-39-17	97-49-227	935.4125 936.0000 937.4375 939.0000 939.4500 939.9625 935.4875 936.7500 937.0000	FB2C	96	100	500	11K0F1D 11K0F2D 11K0F3E

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
				937.6750 938.1375 938.7500 936.2250 938.9625 939.9125					
WQT639	1	6.1 m control stations, TX		155.6700 155.8050	FX1 MO		50 110		20K0F3E
	3	29-42-31.8	98-9-35	155.3100 155.1900 155.3700	FB2 FB2 FB	32 38 45	50 25 110	100 87 234	20K0F3E 20K0F3E 20K0F3E
	5	29-41-56.8	98-7-17	155.1900 155.8050	FB FX1	24 24	55 55	126 63	20K0F3E 20K0F3E
	6	8 km around location 3		154.9500 155.6700 155.6850	MO		110		20K0F3E
KKV500	1	29-45-33.8	98-9-33	154.1300	FB2 FB	30 37	110 110	204 365	15K0F2D 20K0F1D 20K0F3E
	2	29-42-34.8	98-9-33	154.3100	FB	9	40	150	15K0F2D 20K0F1D 20K0F3E
	3	29-42-30.8	98-7-1	154.1300	FB	12	40	150	15K0F2D 20K0F1D 20K0F3E
	4	29-40-30.8	98-9-22	154.1300	FB	12	40	150	15K0F2D 20K0F1D 20K0F3E
	5	29-40-25.8	98-7-31	154.1300	FB	9	40	150	15K0F2D 20K0F1D 20K0F3E
	6	6.1 m control stations, TX		151.0100	FX1		40	40	15K0F2D 20K0F1D 20K0F3E
	7	40 km around location 1		151.0400 154.0100 154.1300 154.3100	MO		110	110	15K0F2D 20K0F1D 20K0F3E

WPQA513—Call sign WPQA513 is an LCRA call sign that provides service for the LCRA tower located in New Braunfels. The call sign covers operations for 20 repeater pairs. While 20 repeaters are not likely utilized at the New Braunfels site, it is likely additional channels are licensed to allow flexibility to add or remove channels from the site

as needed. Frequency 938.1875 MHz is missing the emission designator 11K0F3E; however, this is a minor omission.

WPZL933—Call sign WPZL933 is an LCRA call sign that provides service for the LCRA tower located in central Comal County. The call sign covers operation for seven repeater pairs.

WPMI700—Call sign WPMI700 is an LCRA call sign that provides service for the LCRA tower located in central Guadalupe County (Kingsbury). The call sign covers operations for 15 repeater pairs. While 15 repeaters are not likely utilized at the Kingsbury site, it is likely additional channels are licensed to allow flexibility to add or remove channels from the site as needed.

WQT639—Call sign WQT639 provides service for New Braunfels VHF stations. One repeated channel is used by the New Braunfels PD as a permanent patch to an LCRA talk group. A second repeated channel is used for primary operations by New Braunfels Road and Bridge. A mobile frequency is incorrectly licensed at location 1 which is reserved for control stations meeting the 6.1 meter rule. The license has been updated with narrowband emissions.

KKV500—Call sign KKV500 covers VHF operation for the New Braunfels FD. The license includes the repeater channels 154.1300 MHz (TX) and 151.0400 MHz (RX). Numerous simplex base stations operate on the repeater base frequency 154.1300 MHz. A second simplex frequency, 154.3100 MHz, is licensed. The repeated channel is patched to an LCRA talk group for interoperability purposes. The license has been updated with narrowband emissions.

5.4.2.8 System Coverage

Coverage on the system was indicated to be very good. The system does contain localized coverage “dead spots,” but these gaps are not significant. User reported coverage is as follows:

Table 94 – New Braunfels User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	95%
Portable coverage	95%
In-building coverage	90%

The following map provided by LCRA provides coverage predictions in the New Braunfels area.

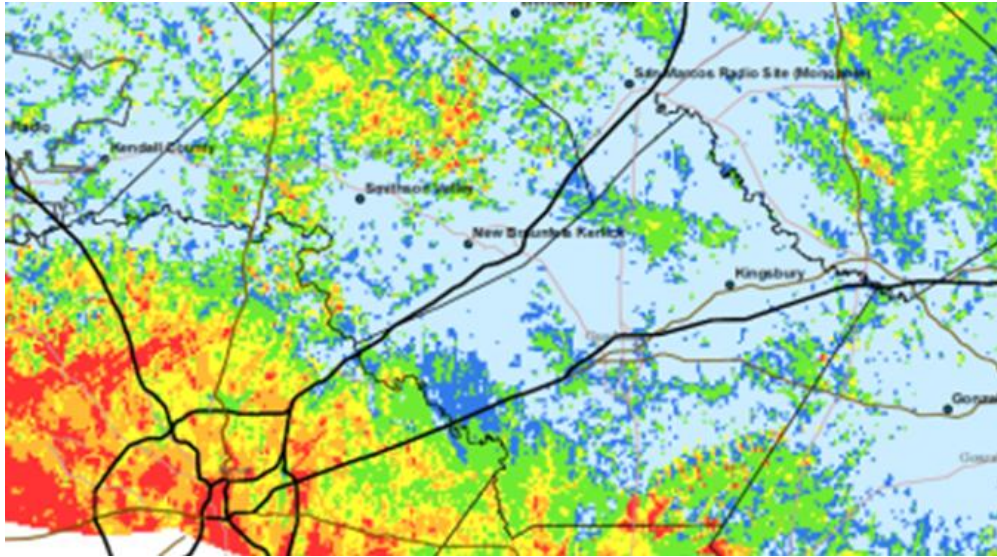


Figure 53 – LCRA-predicted Radio Coverage for New Braunfels

The coverage map confirms that coverage is adequate in the New Braunfels area.

5.4.2.9 Future Plans

New Braunfels plans to migrate their system to the LCRA P25 overlay before the system is cutover exclusively to OpenSky. To complete this migration, the city will require the replacement of virtually all subscriber units. In addition, fixed P25 700 MHz infrastructure will need to be installed at LCRA radio sites providing coverage for the New Braunfels area.

5.4.2.10 Past Expenditures

New Braunfels provided the following past radio expenditures:

Table 95 – New Braunfels Past Expenditures

Year	Project Description	Total Cost	Funding Source
2007	Maintenance	\$29,442.00	New Braunfels
2007	Airtime	\$32,220.00	New Braunfels
2007	8 Mobile Radios	\$24,495.80	New Braunfels
2008	Maintenance	\$33,054.00	New Braunfels
2008	Airtime	\$38,200.00	New Braunfels
2008	5 Mobile Radios	\$16,293.85	New Braunfels
2009	Maintenance	\$34,080.00	New Braunfels
2009	Airtime	\$42,400.00	New Braunfels
2009	5 Portable Radios	\$13,937.10	New Braunfels

Year	Project Description	Total Cost	Funding Source
2010	Maintenance	\$34,080.00	New Braunfels
2010	Airtime	\$34,410.00	New Braunfels
2010	3 Quantar repeaters, 13 APX7000 radios, and 13 XTL2500 VHF radios	\$332,310	SHSP
Total		\$644,923	

5.4.2.11 Future Funding

New Braunfels identified the following future funding opportunities:

Table 96 – New Braunfels Future Funding

Funding Source	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Texas										
PSIC										
IECGP										
AFG										
DHS	\$130,670									
Other	\$34,800 \$54,000	\$35,200 \$60,000	\$35,600 \$66,000	\$36,000 \$72,000	\$36,400 \$78,000	\$36,800 \$84,000	\$37,200 \$90,000	\$37,600 \$96,000	\$38,000 \$102,000	\$38,400 \$108,000
Region										
Total	\$219,470	\$95,200	\$101,600	\$108,000	\$114,400	\$120,800	\$127,200	\$133,600	\$140,000	\$146,400
Total									\$1,306,670	

5.4.2.12 Assessment

Interoperability—The LCRA radio system operates in the 900 MHz frequency band, a band that is not available for public safety on a primary basis. This limitation places public safety tenants on an “island” from other public safety users in that conventional interfaces are the only method of cross-communication between systems. Even with a conventional interface, a coverage footprint needs to exist in both the 900 MHz and frequency band of the other public safety agency. Outside the jurisdictions of public safety users on the LCRA system, few gateways exist to interface local VHF users with the LCRA system. Interoperability was expressed as a concern within the borders of Comal County, as there is limited connectivity between New Braunfels and the Comal County SO and no connectivity with the Comal County fire/EMS departments. VHF radios are deployed in New Braunfels for interoperability with neighboring VHF users; however, some users reported that this method of interoperability is operationally ineffective. Some interoperability problems will be addressed as the system migrates to P25; however, gateway solutions will still be necessary to interface with users in the VHF band.

LCRA Upgrade—Since LCRA is planning to upgrade the system to OpenSky, most radios in the New Braunfels fleet will require replacement before the current EDACS system is decommissioned. Should New Braunfels migrate with

LCRA to 900 MHz OpenSky, the opportunity exists for some radios to be reused; however, most will require replacement. Should New Braunfels upgrade to the LCRA P25 700 MHz overlay, all subscriber equipment will require replacement, but interoperability with Live Oak and COSA/Bexar County will be enhanced.

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5.5 Frio County

Frio County, with an estimated 2009 population of 16,156, is located in the southwestern portion of the AACOG. The county is 1,134 square miles, of which 1 square mile is water. The county is comprised of the cities/towns of Big Foot, Dilley, Frio Town, Hilltop, Moore, North Pearsall, Pearsall, and West Pearsall.

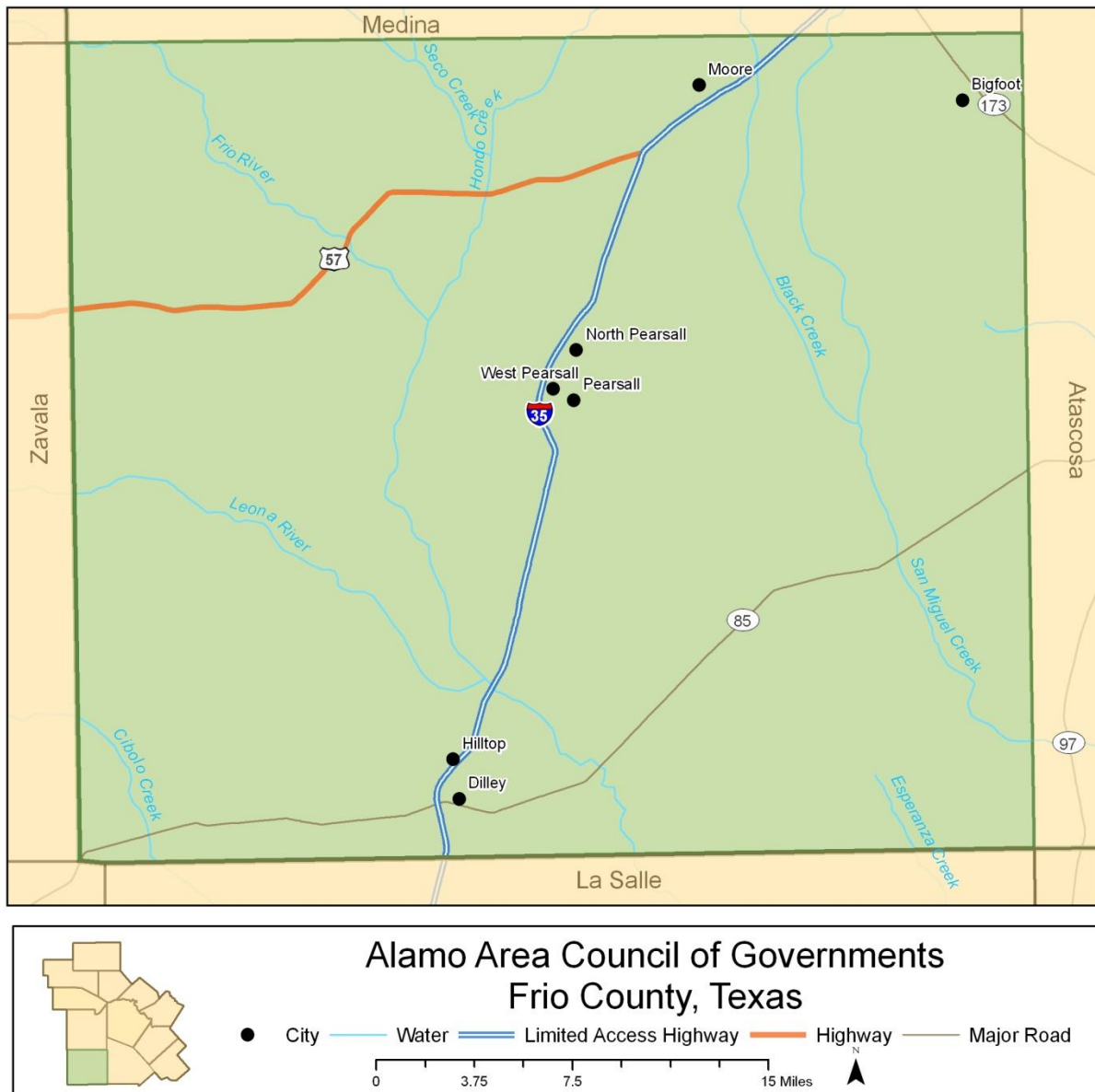


Figure 54 – Frio County

Through the interview and assessment processes, L.R. Kimball found that public safety users within Frio County share one radio system. The radio system covers operations for the Frio County SO, Frio County area VFDs, and the cities of Pearsall and Dilley.

5.5.1 Radio System—Frio County

5.5.1.1 System Description

The Frio County radio system consists of a single repeater located at the Frio County SO that is used by all public safety disciplines, including law enforcement, fire and EMS. A simplex talkaround channel is used for tactical communications for fire and EMS, with a base station located at the main Sheriff's site.

5.5.1.2 User Agencies

The following agencies/entities utilize the Frio County radio system:

Table 97 – Frio County User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Frio County SO	Law Enforcement	Jerry Reyna	830-334-3311	Jerry.reyna@friosheriff.org
Frio County Fire	Fire/EMS	Not Specified	Not Specified	Not Specified
Pearsall PD	Law Enforcement	Henry Martinez	830-334-4169	hmartinez@cityofpearsall.org
Dilley PD	Law Enforcement	Melissa Gonzalez	830-965-1264	cityadministrator@cityofdillextx.com

User agencies on the Frio County radio system include the Frio County SO, area law enforcement (Pearsall PD and Dilley PD), area VFDs (Pearsall VFD, Dilley VFD, Bigfoot VFD and Moore VFD) and Frio County EMS. Pearsall and Dilley PDs have primary jurisdictions within their respective city limits and the SO has jurisdiction throughout the remaining unincorporated areas of the county. The VFDs are responsible for their respective towns. Frio County EMS provides EMS services throughout the county.

Coverage requirements for the SO are primarily mobile and outdoor portable; however, indoor coverage is required occasionally. Personnel are dispatched directly from their vehicles on the SO primary law enforcement channel. Dispatch and tactical communications are both performed on the primary law enforcement channel.

Frio County fire/EMS agencies are dispatched via pagers and the fire/EMS channel. Tactical communications are maintained on the primary fire/EMS channel. The coverage requirement is primarily indoor portable.

5.5.1.3 Dispatch Facilities

The Frio County dispatch center is located at the SO, 502 South Cedar Street, Pearsall. The dispatch center includes two call taker/dispatch positions. The dispatch consoles are Zetron 4010s. These consoles provide limited

push-button functionality, with a maximum support for 10 channels. Channels are listed on the console for Medina and LaSalle; however, the consoles do not support patching, so connectivity is limited to the console.



Figure 55 – Frio County Dispatch Console



Figure 56 – Frio County Dispatch Console (2)

Channels appearing on the console include:

Table 98 – Frio County Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Primary Channel	
Fire / EMS	
IC/CTC	
LaSalle	
Medina	
Paging	

5.5.1.4 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

Coverage—Coverage was indicated to be a severe problem with the Frio County radio system, with coverage estimates listed at 50 percent countywide for portable operation.

Capacity—Capacity on the radio system is limited to one law enforcement channel and one fire/EMS channel. While day-to-day usage does not create a capacity problem, simultaneous incidents can quickly overload capacity on the system.

5.5.1.5 Radio Sites

Frio County provided the following radio site information:

Table 99 – Frio County Radio Site

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Main Sheriff's Site	502 S. Cedar Street	Frio County SO	25 Years	Y

Frio County provided the following radio shelter information:

Table 100 – Frio County Radio Shelters

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
Main Sheriff's Site	10 x 15	Metal and Wood	1985	Y	N

L.R. Kimball took the site photographs that follow.



Figure 57 – Frio County Radio Tower



Figure 58 – Frio County Radio Tower Shelter

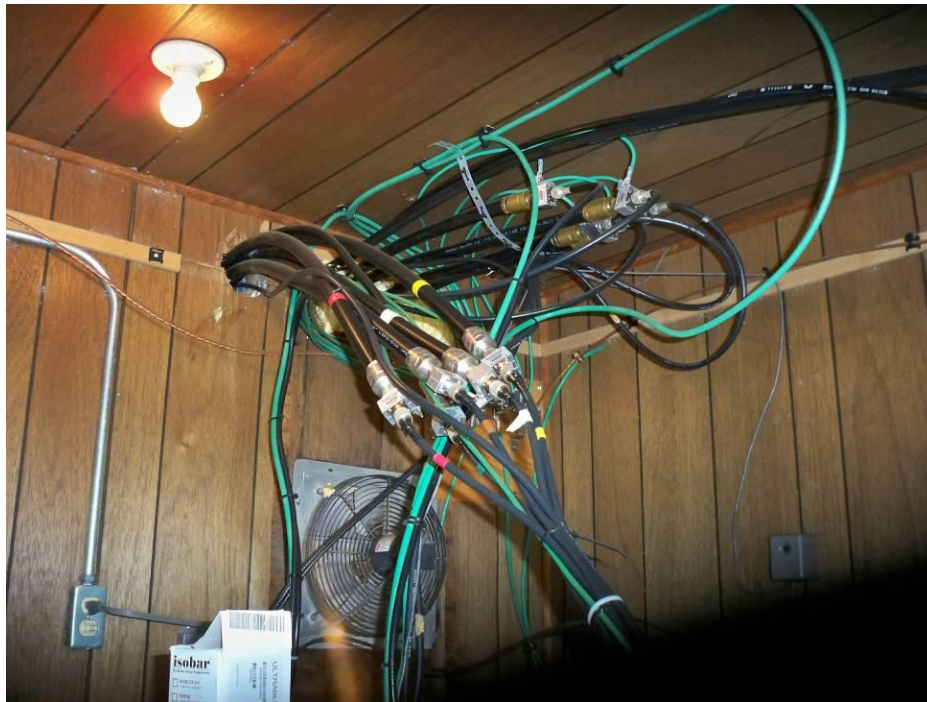


Figure 59 – Frio County Shelter Cables

5.5.1.6 Radio Inventory

Frio County provided the following radio equipment information:

Table 101 – Frio County Radio Equipment

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
Main Sheriff's Site	Main VHF Repeater	Motorola	MSF 5000	155.685 TX 154.800 RX 203.5HZ
Main Sheriff's Site	Inter City Repeater	Motorola	MSF 5000	155.805 TX 153.995 RX 141.3 HZ
Main Sheriff's Site	Fire Channel	Motorola	MSF 5000	154.950 TX 154.950 CSQ

Table 102 – Frio County Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Frio SO	Motorola	XTS 5000 and XTL 5000	Not Specified	13 Portable 13 Mobile
Pearsall PD	Motorola	Not Specified	Not Specified	15 Portable 6 Mobile
Dilley PD	Motorola and Kenwood	Not Specified	Not Specified	5 Portable 8 Mobile

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Pearsall FD	Motorola and Kenwood	Not Specified	Mobile and Portable	9 Mobile 20 Portable
Dilley FD	Motorola and Kenwood	Not Specified	Mobile and Portable	9 Mobile 20 Portable
Bigfoot FD	Motorola and Kenwood	Not Specified	Mobile and Portable	5 Mobile 22 Portable
Moore FD	Motorola and Kenwood	Not Specified	Not specified	Not specified
Frio County EMS	Motorola and Kenwood	Not Specified	Mobile and Portable	8 Mobile 8 Portable
Total Mobiles				84
Total Portables				68
Total Control Stations				0
Total				152

5.5.1.7 FCC Licenses

Table 103 – Frio County FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WNXY757	1	28-53-12.9	99-5-34.1	155.8050	FB2	73	110	168	20K0F3E
	2	29-3-47.9	99-00-21.1	155.8050	FB	12	40	40	16K0F2D 20K0F1D 20K0F3E
	3	64 km around location 1		153.9950	MO		110		20K0F3E
		29-02-57	98-51-57	155.8050	FB	15	40	100	16K0F2D 20K0F1D 20K0F3E
KVF687	1	28-53-12.9	99-5-34.1	155.3700 155.6850	FB FB2	73 82	110 110	330 230	20K0F3E
	2	64 km around location 1		154.8000 154.9500	MO		110		20K0F3E

WNXY757—Call sign WNXY757 covers the repeater frequencies 155.8050 MHz (TX) and 153.9950 MHz (RX). This channel is used as the primary law enforcement dispatch and tactical channel. Simplex base stations are licensed on the transmit frequency, 155.8050 MHz, in Moore and Bigfoot, Texas. It is likely these stations are operating as control stations and could be licensed appropriately. As licensed, the stations would only receive talkaround traffic, as talkaround operation on the base frequency 155.8050 MHz is not covered on the license. The license reflects

wideband operation and requires the addition of the narrowband emission designator 11K0F9W to cover voice and paging.

KVF687—Call sign KVF687 covers the repeater frequencies 155.6850 MHz (TX) and 154.8000 MHz (RX). The channel is the primary fire dispatch and tactical channel. The station covers simplex operation of TXLAW2 and mobile operation of TXLAW1. The station does not cover control station or talkaround operation. The station reflects the wideband emission 20K0F3E and requires the addition of the narrowband emission 11K0F3E to satisfy the FCC's narrowbanding mandate prior to January 1, 2013.

5.5.1.8 System Coverage

L.R. Kimball found that radio coverage was indicated to be a major problem within Frio County. User reported coverage is as follows:

Table 104 – Frio County User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	50%
Portable coverage	50%
In-building coverage	50%

The following coverage map depicts the predicted “talk out” portable coverage for the Frio County law enforcement and fire/EMS channels. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

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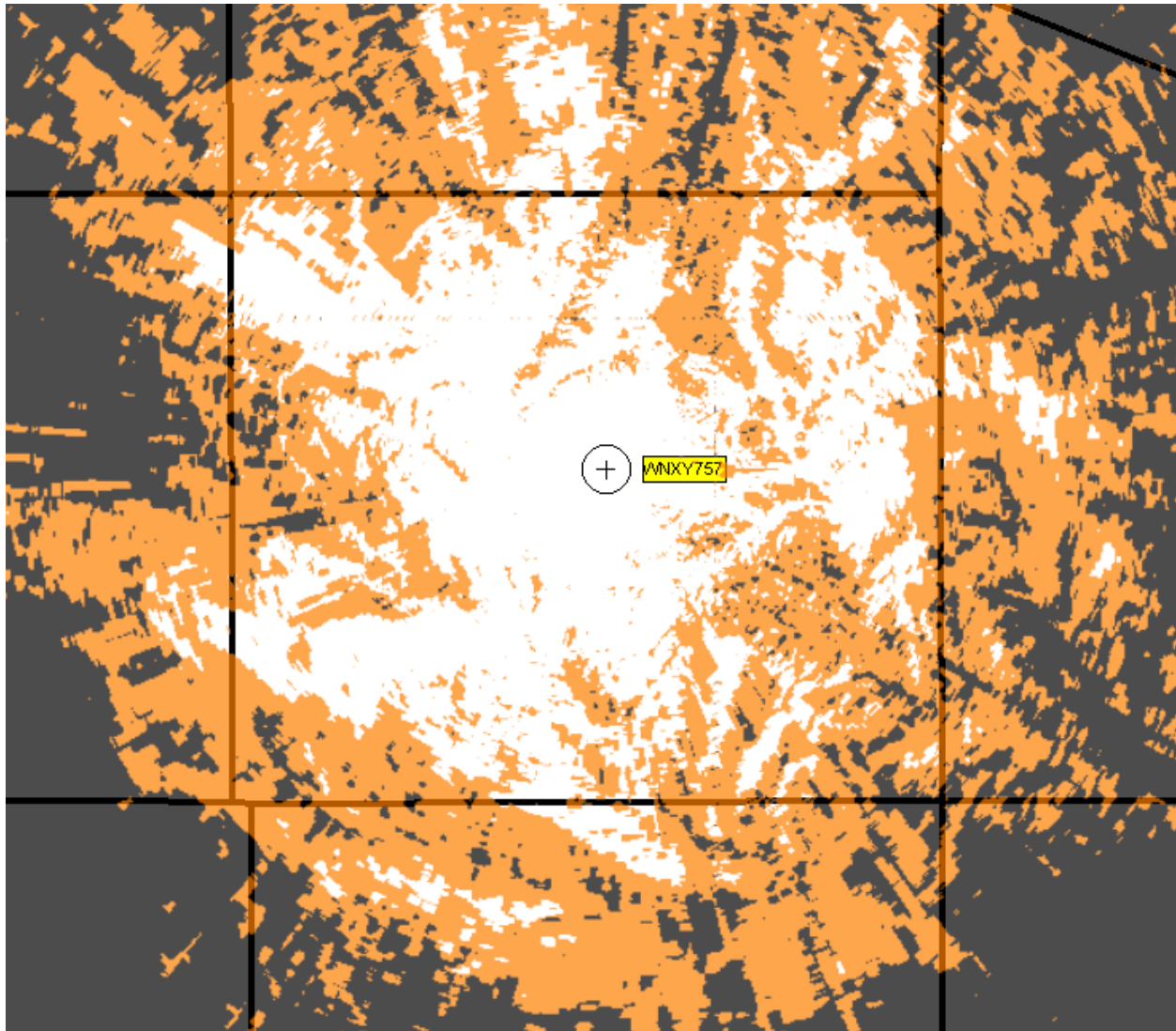


Figure 60 – Predicted Radio Coverage for Frio County

The map confirms that numerous coverage gaps exist within Frio County. However, portable coverage is likely better than the 50 percent estimated. If coverage is significantly worse than that predicted in the map, the potential exists for there to be a problem with the existing transmitter systems. If coverage problems are limited to “talk back” from the user to the dispatcher, this map will neither confirm nor deny those problems. Based on the placement of the existing radio site shown above, it is likely several more radio sites will be necessary to provide adequate coverage throughout the county.

5.5.1.9 Future Plans

Frio County indicated the following future plans:

- Purchasing 3G broadband air cards
- Purchasing a reporting system with CAD
- Improving radio system coverage throughout the county

5.5.1.10 Past Expenditures

Frio County provided the following past radio expenditures:

Table 105 – Frio County Past Expenditures

Year	Project Description	Total Cost	Funding Source
2009	New Mobile and Portable radios	\$115,000	State government earmark
Total		\$115,000	

5.5.1.11 Future Funding

Frio County identified the following future funding opportunities:

Table 106 – Frio County Future Funding

Funding Source	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Texas										
PSIC										
IECGP										
AFG										
DHS										
Other		\$2,000,000								
Region										
Total		\$2,000,000								
Total									\$2,000,000	

5.5.1.12 Assessment

Coverage—Radio system user feedback indicated mobile and portable coverage was limited to 50 percent of the county. Lack of radio coverage severely limits the ability of first responders to call for backup or alert dispatchers in an emergency. Most radio systems include some “dead spots,” either in-building or in terrain-challenged areas, but lack of service and radio coverage in approximately half of a jurisdiction causes significant concern.

Reliability—The County indicated that radio system reliability is questionable due to equipment age and location. First and foremost, system coverage is dependent on MSF5000 repeaters which are nearly 20 years old and well beyond the expected life cycle of repeater equipment. Equipment becomes less reliable as it ages and serviceability

decreases. These repeaters are more prone to failure and could be difficult to repair if a failure occurs. Second, all fixed radio equipment is at one location. A single lightning strike could easily disable all radio systems within the county. Third, the radio tower and shelter are considerably aged. At 25 years old, the reliability of these structures may be questionable.

Narrowbanding—Currently, all Frio County equipment is operating in the wideband (20 kHz) mode. By 2013, all VHF and UHF systems must operate in the narrowbanding mode, meaning equipment will operate on a 12.5 kHz channel. While some equipment provided in the inventory is narrowband capable, much of the equipment is not. MSF5000 repeater stations are not narrowbanding capable and need to be replaced by 2013, along with the remaining non-compliant subscriber units.

Channel Capacity—While a single repeated channel may provide sufficient capacity on a day-to-day basis, communications may be inhibited if multiple events occur simultaneously. While talkaround channels can be used to alleviate some capacity concerns, additional repeater channels are ideal.

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5.6 Gillespie County

Gillespie County, with an estimated 2009 population of 24,180, is located in the northern portion of the AACOG. The county is 1,061 square miles. The county is comprised of the cities/towns of Albert, Cherry Spring, Crabapple, Doss, Fredericksburg, Harper, Luckenbach, Stonewall and Willow City.



Figure 61 – Gillespie County

Through the interview and assessment processes, L.R. Kimball found that there are two primary radio systems utilized by public safety agencies within Gillespie County; a VHF conventional system utilized by Gillespie County fire/EMS and the LCRA 900 MHz EDACS system utilized by the Gillespie County SO and the city of Fredericksburg.

5.6.1 Radio System—Gillespie County Fire/EMS

The Gillespie County fire/EMS system consists of multiple VHF conventional base stations. Tower sites are located in the central, western and eastern areas of the county. A VHF Low band paging base station is located on a separate tower. Dispatch is provided from the fire/EMS department.

Separate channels are used to dispatch fire/EMS departments throughout the county. Primary dispatch for Fredericksburg fire/EMS takes place on the fire/EMS repeater located in Fredericksburg. The west repeater is used to dispatch Doss VFD, the east repeater is used to dispatch Harper VFD/EMS and a simplex channel is used to dispatch Stonewall VFD. A patch to the LCRA system is used to dispatch Willow City VFD.

The following table summarizes the frequencies used within the system:

Table 107 – Gillespie County Radio Frequencies

Channel Name	Call Sign	TX Frequency (MHz)	RX Frequency (MHz)	PL Tone (Hz)	Description
Primary		154.4450	153.8900	162.2	Dispatch Channel for Central Repeater
East		155.8875	153.9425	162.2	East Repeater
West		154.0325	150.8050	179.9	West Repeater
TXFIRE1		154.2800	154.2800	CSQ	Interop
TXLAW2		155.3700	154.9500	CSQ	Interop
Fire/EMS BS		154.4450	154.4450	162.2	Primary Repeater Talkaround

5.6.1.1 User Agencies

The following agencies/entities utilize the Gillespie County system:

Table 108 – Gillespie County User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Doss VFD	Fire	Mark Geistweidt	830-669-2220	markgeistwedt@gmail.com
Fredericksburg FD	Fire	Steve Olfers	830-997-7521	solfers@fbgtx.org
Fredericksburg EMS	EMS	David Jung	830-997-7521	djung@fbgtx.org
Harper VFD	Fire	John Tittle	830-864-4444	jtittle@ctesc.net

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Harper EMS	EMS	John Tittle	830-864-4444	jtittle@ctesc.net
Stonewall VFD	Fire	Bradley Nielsen	830-644-5571	bradleynielsen@beecreek.net
Tierra Linda	Fire	Ed Marker	830-792-3533	Whit.twodogranch@gmail.com
Willow City VFD	Fire	Stanley Rabke	830-685-3376	s.rabke@yahoo.com

Fire/EMS users are dispatched based upon fire districts assigned to each VFD. Communications are maintained between the dispatch center and the FDs via control stations located at each VFD. Paging is used as the primary method to contact volunteers on a VHF Low band system. No coverage problems were indicated on the paging system. The coverage requirement for fire users is indoor portable. Primary dispatch is performed on the fire/EMS repeater centrally located within the county. West and east repeaters, belonging to Doss VFD and Willow City VFD, are used for dispatch and tactical operations when necessary. When coverage is insufficient on repeated channels or when multiple incidents occur at one time, traffic is off-loaded to a simplex talkaround channel, typically TXFIRE1.

5.6.1.2 Dispatch Facilities

Primary dispatch for the system is conducted at the Fredericksburg FD, 124 W. Main Street, Fredericksburg. The dispatch console is a single Zetron 4010. The Gillespie County Law Enforcement dispatch center serves as the primary backup and is located at 100 S. Nimitz Parkway, Fredericksburg.

The console interface uses control stations connected to yagi antennas to interface with the repeated channels located at the three primary repeater sites. These RF control links serve as the primary method of connectivity in the radio system.

The Zetron 4010 console is a push-button style console that is currently at its maximum capacity of ten channels. The console supports the ability to patch two distinct frequencies at an audio level. User feedback indicates this patching functionality is used for mutual aid.

A VHF wildcard radio is interfaced with the console that allows the user to change channels to one of many programmed frequencies. The frequencies can be adjusted to various TX interoperability frequencies and primary frequencies of adjacent jurisdictions.

Channels appearing on the console include:

Table 109 – Gillespie County Fire/EMS Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Fbg Pri	Fire/EMS Repeater
SWVFD	Fire/EMS Simplex

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
WCVFD	LCRA
DossVFD	West Repeater
HVFD	East Repeater
	VHF Wild
	West Pager
	Intercom
	East Pager
City low Band	Co Wide Page

5.6.1.3 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

Coverage—Coverage is currently the primary limitation of the Gillespie County fire/EMS system. It is estimated that three additional tower sites will be necessary to provide adequate coverage throughout the county.

Radio Quantities—The group indicated that there is a desire to increase the total number of subscriber radios in the field.

Replacing Equipment—An ongoing effort over the next ten years is necessary to replace aging equipment.

5.6.1.4 Radio Sites

Gillespie County provided the following radio site information:

Table 110 – Gillespie County Fire/EMS Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Pager Tower	2087 Ranch Road 967			Unknown
East Repeater	8 Miles north of Fredericksburg on State Hwy 16 North	Five Star Cellular		Unknown
West Repeater	5 Miles north of Harper on FM 783	Five Star Cellular		Unknown
Central Tower	Metzger Rd. on Tribes Hill	Gillespie County		Unknown

Gillespie County provided the following radio shelter information:

Table 111 – Gillespie County Fire/EMS Radio Shelters

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
Central Tower	10'x15'	Concrete block		Y	
East Repeater	5'X10'	Wood	2005	Y	
West Repeater	5'X10'	Wood	2005	Y	
Pager Tower	10'X15'	Concrete block		Y	

5.6.1.5 Radio Inventory

Gillespie County provided the following radio equipment information:

Table 112 – Gillespie County Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Doss VFD	Not Provided	Undefined VHF	All	30 (estimate)
Fredericksburg FD	Not Provided	Undefined VHF	All	30 (estimate)
Fredericksburg EMS	Not Provided	Undefined VHF	All	10 (estimate)
Harper VFD	Not Provided	Undefined VHF	All	30 (estimate)
Harper EMS	Not Provided	Undefined VHF	All	10 (estimate)
Stonewall VFD	Not Provided	Undefined VHF	All	30 (estimate)
Tierra Linda	Not Provided	Undefined VHF	All	30 (estimate)
Willow City VFD	Not Provided	Undefined VHF	All	30 (estimate)
Total Mobiles				
Total Portables				
Total Control Stations				
Total				200 (estimate)

5.6.1.6 FCC Licenses

Table 113 – Gillespie County FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WNLN713	1	30-18-25.7	98-54-4.1	154.4450	FB2	82	300	300	20K0F3E
	2	Gillespie County, TX		153.8900 154.2650 154.2800 154.2950	MO		100		20K0F3E

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WQEL268	1	30-20-29	99-13-24	154.0325	FB2	83.8	75	138	11K2F3E
	2	30-21-26	98-46-15	155.8875	FB2	83.8	75	77	11K2F3E
	3	32 km around location 1		154.0325 150.8050	MO		45	45	11K2F3E
	4	32 km around location 2		153.9425 155.8875	MO		45	45	11K2F3E
	5	6.1 m control stations, TX		150.8050 153.9425	FX1		40	30	11K2F3E
KVF680	1	30-18-25.7	98-54-4.1	155.7300	FB2	88	200	300	11K3F1D 11K3F3E 20K0F3E
	2	30-15-43.7	98-52-59.1	155.3700	FB	30	100	316	11K3F1D 11K3F3E 20K0F3E
	3	6.1 m control stations, TX		155.0100	FX1		100	100	11K3F1D 11K3F3E 20K0F3E
	4	80 km around location 1		154.9500 155.0100	MO		100	100	11K3F1D 11K3F3E 20K0F3E

WNLN713—Call sign WNLN713 covers operation of the repeater frequency 154.4450 MHz (TX) and 153.8900 MHz (RX). This channel serves as the primary dispatch and tactical frequency for Gillespie County fire/EMS. The channel is located at the central repeater. In addition to the repeater frequency, the license covers mobile operation on TXFIRE1 and talkaround operation on 154.2650 MHz and 154.2950 MHz. The emission designator on the license is 20K0F3E, which reflects wideband operation. The narrowband emission 11K0F3E must be added to the license prior to January 1, 2013 to demonstrate narrowband compliance.

WQEL268—Call sign WQEL268 covers operations of the two repeater channels. The first channel is 154.0325 MHz (TX) and 150.8050 MHz (RX), which serves as the west repeater. The second channel is 155.8875 MHz (TX) and 153.9425 MHz (RX), which serves as the east repeater. The call sign covers talkaround and control station operation. The license includes the narrowbanding emission 11K2F3E.

KVF680—Call sign KVF680 covers operation of the repeater frequency 155.7300 MHz (TX) and 155.0100 MHz (RX). The station covers operation of TXLAW1 and TXLAW2. The license covers talkaround and control station operation. The license includes the narrowband emissions.

5.6.1.7 System Coverage

Coverage on the fire system was indicated to be a concern by representatives of Gillespie County. User reported coverage is as follows:

Table 114 – Gillespie County User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	85%
Portable coverage	70%
In-building coverage	50%

The following map depicts the predicted “talk out” portable coverage for the Gillespie County primary, west, and east sites. The map displays the strongest signal strength from all conventional tower sites. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

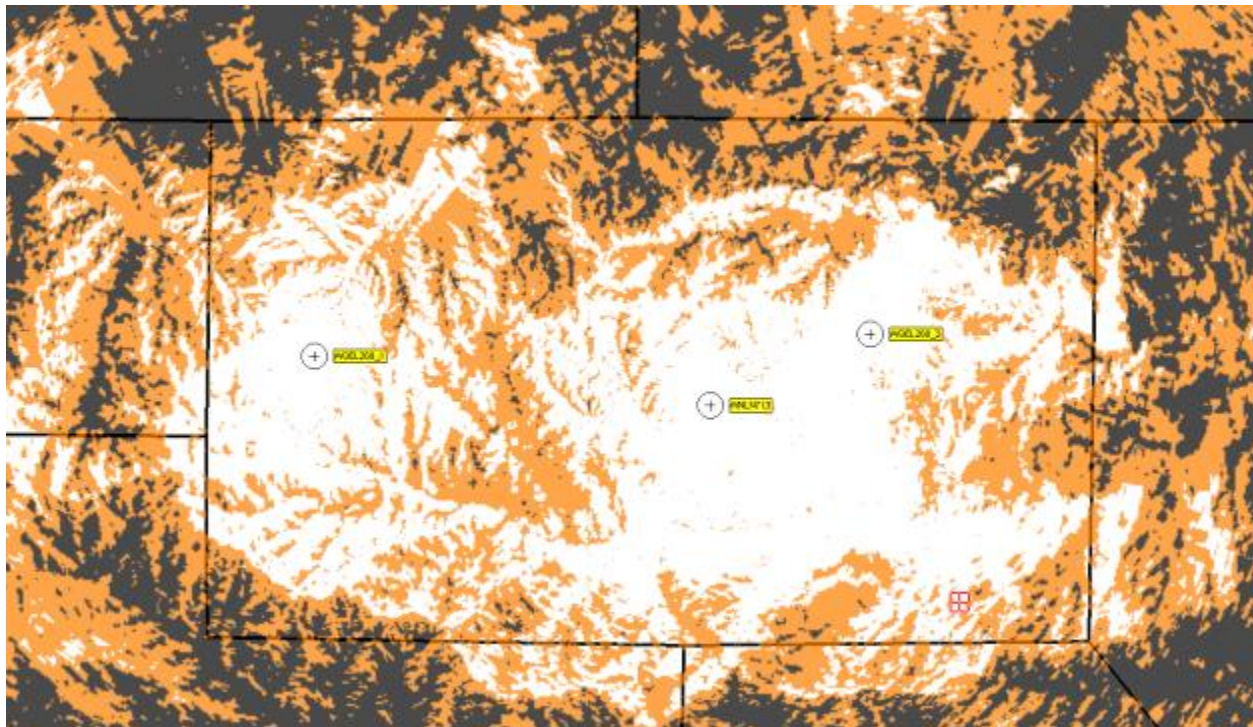


Figure 62 – Predicted Radio Coverage for Gillespie County Fire/EMS

The coverage map agrees with the feedback provided by Gillespie County users on the fire/EMS system. Portable coverage is likely limited in portions of the county, particularly along the northern border and the southwestern area. There are likely coverage holes in the central and eastern portions of the county. Using the existing sites, it is likely

several more tower sites will be necessary to provide countywide coverage. Gillespie County representatives estimate three additional tower sites are necessary. L.R. Kimball agrees that three or more will be necessary to provide sufficient portable coverage countywide.

5.6.1.8 Future Plans

Gillespie County plans to continue to replace older radio equipment on a year-to-year basis and upgrade fire truck radios to P25 in 2015.

5.6.1.9 Past Expenditures

Gillespie County provided the following past radio expenditures:

Table 115 – Gillespie County Past Expenditures

Year	Project Description	Total Cost	Funding Source
2007 – Present	Recurring system costs	\$23,146.04	Not Specified
2007 – Present	Willow City VFD	\$12,349.00	Not Specified
2007 – Present	Harper VFD	\$11,780.00	Not specified
2007	Radio Programming	\$3,000.00	Not Specified
2009	Radio Programming	\$3,000.00	Not Specified
Total		\$53,275.04	

5.6.1.10 Future Funding

Gillespie County identified the following future funding opportunities:

Table 116 – Gillespie County Future Funding

Funding Source	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Texas										
PSIC										
IECGP										
AFG										
DHS										
Other	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Region										
Total	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Total									\$100,000	

5.6.1.11 Assessment

Coverage—User feedback indicated that the present radio system provides approximately 70 percent outdoor portable coverage and indoor coverage throughout half of the county. About 15 percent of the land area is not served by mobile coverage. A first responder is at a great risk any time they need to respond to an incident outside of radio coverage. For fire/EMS, indoor coverage is especially critical. While simplex frequencies can be used to coordinate an event on-scene while outside of the system coverage area, radio coverage is necessary for calls for backup and to coordinate with other users.

Conventional Architecture—The present Gillespie County fire/EMS system uses three repeaters and a simplex frequency for dispatch and tactical operations throughout the county. For one dispatcher, monitoring and managing four different frequencies with different coverage areas can be difficult. The problem would be compounded if additional conventional repeater sites are utilized to enhance coverage.

Interoperability—The system currently has no method of connectivity to 800 MHz users who may respond from the Bexar County area and connectivity to the Fredericksburg system is limited by a minimal number of patched frequencies. Fredericksburg fire/EMS maintains approximately sixteen 900 MHz radios that can be used on the law enforcement system; however, resources are still limited for the remaining fire/EMS departments.

5.6.2 Radio System—City of Fredericksburg and Gillespie County Sheriff

All law enforcement services within Gillespie County are combined onto one shared radio system using the LCRA 900 MHz EDACS system.

Multiple radio sites contribute to coverage in the Gillespie County area. The sites are arranged in a multi-cast configuration, with different frequencies at each site. Channel capacity at each site ranges from five to twelve frequencies.

Plans are underway to upgrade the 900 MHz EDACS system to Harris OpenSky. Capital costs for the implementation of P25 equipment must be covered by public safety agencies. Virtually all Gillespie County radios must be replaced prior to the complete cutover of the LCRA system to OpenSky.

Between the law enforcement users and Fredericksburg Fire/EMS tenants, five talk groups have been assigned to the Gillespie County SO and one talk group each has been assigned to Fredericksburg PD, Fredericksburg FD, EMS and utilities. One talk group is permanently patched to the old Gillespie County VHF repeater, which is used for interoperability with the county fire/EMS departments.

5.6.2.1 User Agencies

The following agencies/entities utilize the Fredericksburg/Gillespie County SO radio system:

Table 117 – Fredericksburg/Gillespie County Sheriff User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Gillespie County SO	Law Enforcement	Not Specified	Not Specified	Not Specified
Fredericksburg PD	Law Enforcement	Not Specified	Not Specified	Not Specified
Fredericksburg Fire	Fire	Not Specified	Not Specified	Not Specified
Fredericksburg EMS	EMS	Not Specified	Not Specified	Not Specified

5.6.2.2 Dispatch Facilities

Fredericksburg and Gillespie County did not provide dispatch or console information.

5.6.2.3 Focus Groups

Feedback from the city of Fredericksburg and Gillespie County indicated that needs were met on the current LCRA 900 MHz EDACS system. Fredericksburg and Gillespie County must migrate to a new system with the pending decommissioning of the LCRA EDACS system. Primary options include the LCRA 900 MHz OpenSky system or the 900 MHz regional system hosted by LCRA. The preferred path for Fredericksburg is the 700 MHz P25 system.

5.6.2.4 Radio Sites

Based on information by LCRA, L.R. Kimball determined that there are four primary LCRA locations which contribute to radio coverage within Gillespie County.

Table 118 – Gillespie County LCRA Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Lukenbach	6 miles SW, Lukenbach, TX	Not Provided	Not Provided	Y
Fredericksburg	1.5 miles east of INT of HWY 87 & 2323, Fredericksburg, TX	Not Provided	Not Provided	Y
Doss	1 mile SW of INT of Reech & Crenwelge Rd, Doss, TX	Not Provided	Not Provided	Y
Kerrville	3.5 miles east, Kerrville, TX	Not Provided	Not Provided	Y

Table 119 – Gillespie County LCRA Radio Shelters

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
Lukenbach	Not Provided	Concrete	Unknown	Y	Y

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
Fredericksburg	Not Provided	Concrete	Unknown	Y	Y
Doss	Not Provided	Concrete	Unknown	Y	Y
Kerrville	Not Provided	Concrete	Unknown	Y	Y

5.6.2.5 Radio Inventory

Fredericksburg and Gillespie County Sheriff provided the following radio equipment information:

Table 120 – Fredericksburg/Gillespie County Sheriff Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Gillespie County	Harris	P 5300	Portable	6
	Harris	P 5300	Mobile	4
	Ericsson	LPE 200	Portable	39
	Ericsson	LPE 200	Mobile	36
	Ericsson	Z TRON/ORION	Control Station	7
Fredericksburg PD	Harris	LPE/P5350	Portable	43
	Harris	Orion/500M/M5300	Mobile	36
	Harris	Orion	Control Station	1
Fredericksburg EMC/EMS	Harris	LPE/P5370	Portable	4
	Harris	Orion/M5300	Mobile	6
	Harris	Orion	Control Station	1
Fredericksburg Fire	Harris	P5350	Portable	5
Total Mobiles				82
Total Portables				97
Total Control Stations				9
Total				188

5.6.2.6 FCC Licenses

Table 121 – LCRA FCC Licenses (Gillespie County)

Call Sign	Location	Latitude (N) / Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WPLZ920	1	30-22-23	99-5-3	936.4500 936.1375 937.4500	FB2	112	100	500	11K0F1D 11K0F2D 11K0F3E

Call Sign	Location	Latitude (N) / Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
				938.0000 939.9625 935.4500 936.9250 937.2000 937.4000 937.9250					
	2	30-3-19	99-3-50	935.4125 936.0000 939.0000 939.4500 939.9625 935.4500 936.9250 935.2125 935.2375 935.4000 935.6375 937.5000 937.6375 937.6625 937.6875	Fb2	96	100	500	11K0F1D 11K0F2D 11K0F3E
	3	30-8-3	98-40-21	936.4250 937.3875 937.9000 938.4500 939.6750	FB2C	138	100	500	11K0F1D 11K0F2D 11K0F3E
WPNS694	3	30-22-43.7	98-55-54.2	935.1500 935.5000 935.9125 937.1875 938.1500	FB2C	57.9	100	500	11K0F1D 11K0F2D 11K0F3E

WPLZ920—Call sign WPLZ920 is licensed by LCRA and covers the operation of 900 MHz trunked radio sites, which include the Kerrville, Doss, and Lukenbach sites. These sites contribute to coverage within Gillespie County. Ten channels are licensed at the Doss site, fifteen channels are covered at the Kerrville site, and five channels are covered at the Lukenbach site. The license reflects narrowband analog operation; however, legacy EDACS system operation utilizes the 20K0F3E emission. Mobiles and control stations are covered on a separate license.

WPNS694—Call sign WPNS694 is licensed by LCRA and covers operation of 900 MHz trunked radio sites, which include the Fredericksburg site. The site is licensed for five channels. The license reflects narrowband analog operation; however, legacy EDACS system operation utilizes the 20K0F3E emission. Mobiles and control stations are covered on a separate license.

5.6.2.7 System Coverage

No coverage problems were reported by Gillespie County. Coverage reported by LCRA is as follows:

Table 122 – Gillespie County LCRA Reported Coverage

Radio System Coverage Levels	
Mobile coverage	94%
Portable coverage	72%
In-building coverage	Not Provided

5.6.2.8 Future Plans

Fredericksburg currently operates 96 subscriber radios on the LCRA system and the Gillespie County SO operates 91 subscriber radios. P5350 portables and M5300 mobiles can be upgraded to work in P25 trunking mode. All other radio models used in Gillespie County must be replaced.

5.6.2.9 Past Expenditures

Fredericksburg and Gillespie County did not provide past radio expenditures.

5.6.2.10 Future Funding

Fredericksburg and Gillespie County did not identify future funding opportunities.

5.6.2.11 Assessment

Interoperability—The LCRA radio system operates in the 900 MHz frequency band that is not available for public safety on a primary basis. This limitation places public safety tenants on an “island” from other public safety users in that conventional interfaces are the only method of cross-communication between systems. Even with a conventional interface, a coverage footprint needs to exist in both 900 MHz and the frequency band of the other public safety agency. Outside the jurisdictions of public safety users on the LCRA system, few gateways exist to interface local VHF users with the LCRA system. Some interoperability problems will be addressed as the system migrates to P25; however, gateway solutions will still be necessary to interface with users in the VHF band.

LCRA System Migration—The LCRA system is planning to migrate primary operations to OpenSky. Most of the radios operated by Fredericksburg and Gillespie County are not OpenSky capable, and therefore a significant investment is necessary. If Fredericksburg and Gillespie County wish to remain on the LCRA system then a migration to either 700 MHz P25 or OpenSky is necessary.

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5.7 Guadalupe County

Guadalupe County, with a population of 121,432 as of the 2009 estimated Census, is a south central Texas county encompassing 714 square miles. Cities and towns include Cibolo, Geronimo, Kingsbury, Marion, McQueeney, New Berlin, New Braunfels, Northcliff, Redwood, Santa Clara, Schertz, Seguin, Staples, and Zuehl.

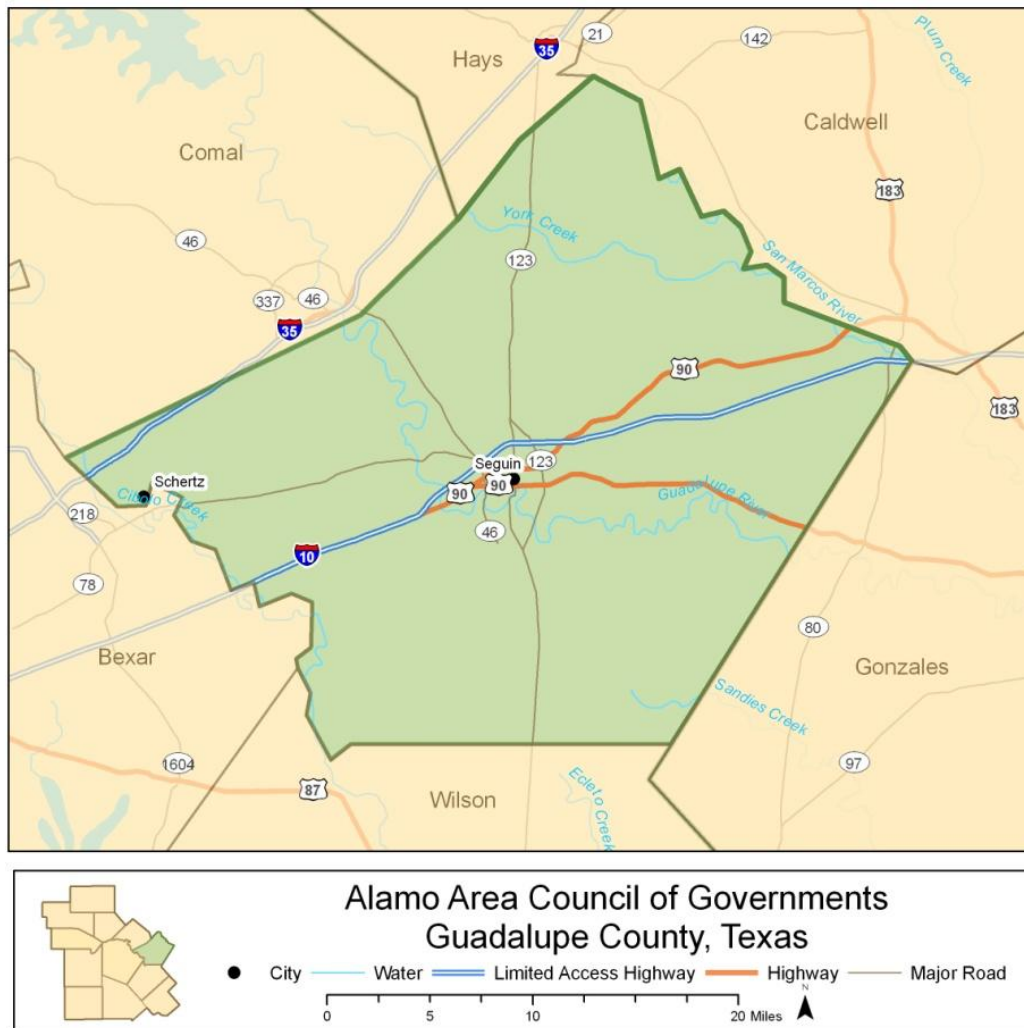


Figure 63 – Guadalupe County

Two radio systems are in use by the county – one for the Guadalupe County SO and a second licensed to the Guadalupe County Firefighters Association. The Guadalupe County Firefighters Association is licensed for five VHF frequencies for mobile use and utilizes other frequencies both in mobile and repeater operation that are licensed to

the Guadalupe County SO. The county radio systems operate in the VHF portion of the spectrum, though Guadalupe County Fire utilizes two UHF frequencies licensed to the SO for portable operation.

Additional systems within the county include those in use by the Cibolo PD and FD, the Schertz PD and FD, the New Berlin VFD and the Seguin PD and FD. The Schertz PD and FD operate on the Live Oak/Converse/Selma radio network.

5.7.1 Radio System—Guadalupe County

The Guadalupe County radio system consists of four conventional repeaters – two repeaters each for the SO and fire operations. Transmitters are located at two sites covering the eastern and western portions of the county. Voted satellite receivers using microwave backhaul enhance “talk back” coverage throughout portions of the county. The channels operate in the VHF band in the wideband analog mode. The channels are utilized for dispatch and tactical operations. Existing infrastructure is manufactured by Motorola, and subscriber radios are a mix of Kenwood, Motorola, ICOM, Vertex, and Puxing.

Plans are in place to upgrade the existing VHF conventional system with a Kenwood NEXEDGE system. A P25 conventional repeater has been purchased by Guadalupe County to provide patching connectivity to P25 primary agencies.

The New Berlin VFD operates its own repeater system for tactical communications.

5.7.1.1 User Agencies

The following agencies/entities utilize the Guadalupe County radio system:

Table 123 – Guadalupe County User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Gillespie SO	Law Enforcement	Not Specified	Not Specified	Not Specified
Marion PD	Law Enforcement	Not Specified	Not Specified	Not Specified
DPS	Law Enforcement	Not Specified	Not Specified	Not Specified
Game Warden	Law Enforcement	Not Specified	Not Specified	Not Specified
9 VFDs	Fire	Not Specified	Not Specified	Not Specified
4 EMS	EMS	Not Specified	Not Specified	Not Specified

User agencies on the Guadalupe County radio system include the Guadalupe County SO, the Marion PD, nine area VFDs, and EMS. The TXDPS/Highway Patrol and game wardens from Texas Parks & Wildlife are “guest” users on the system. The Marion PD has primary jurisdiction within the Marion city limits. The Guadalupe County SO has primary jurisdiction in all unincorporated areas of the county. VFDs have responsibility for the area within their Emergency Services District or other geographic area.

Coverage requirements for the SO are primarily mobile and outdoor portable; however, indoor coverage is required occasionally. Personnel are dispatched directly from their vehicles on the SO primary law enforcement channel. Dispatch and tactical communications are performed on the primary law enforcement channel and some tactical and coordination activities take place on the simplex talkaround channel.

Frio County fire/EMS agencies are dispatched via pagers and the east or west side dispatch channel as appropriate. Some tactical communications takes place on the repeated primary channel, but five simplex channels are allocated for fireground communications. Fire and EMS require portable in-building coverage and outdoor mobile/portable coverage.

5.7.1.2 Dispatch Facilities

The primary dispatch center is located at 2617 North Guadalupe Street, Seguin. The center has four Zetron 4020 dispatch consoles interfaced with the radio system. The consoles provide a liquid crystal display (LCD) with patching capabilities.

Channels appearing on the console include:

Table 124 – Guadalupe County Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Channel 1	Back up channel
Channel 2	West side channel
Channel 3	East side channel
Court house	Court house
Fire Channel 1	East side channel
Fire Channel 2	West side channel
Intercity	Intercity

A secondary PSAP for Gillespie County is located at the Seguin PD 350 North Guadalupe Street, Seguin.

5.7.1.3 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

Interference—It was indicated that interference was a problem for the current system.

Coverage—While the current coverage provides approximately 95 percent mobile coverage and 85 percent portable coverage, coverage issues were noted to be a problem. The County believes additional radios sites and trunking architecture are needed to address the coverage problems.

5.7.1.4 Radio Sites

Guadalupe County provided the following radio site information:

Table 125 – Guadalupe County Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Old Lehman Rd	1256 Old Lehman Rd., Seguin, TX	S & P Communications	7 years	Y
Old Stagecoach Rd	Stagecoach Rd and SH465	Green Valley Water Supply	Not Specified	N
Marion Water Tower	Damerau Water Tower	Canyon Regional Water Supply	Not Specified	N
Mesquite Pass	FM467 near intersection w/Mesquite Pass	Not Specified	Not Specified	N
Courthouse	County Courthouse	Guadalupe County	Not Specified	N

Guadalupe County provided the following radio shelter information:

Table 126 – Guadalupe County Radio Shelters

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Old Lehman Rd		Metal frame Comm Bldg	2003	Y
Marion Water Tower		System installed in base of tower	2007	N
Old Stagecoach Rd		Wooden frame building		Y
Mesquite Pass		Wooden frame Building		Y
Courthouse		Equipment Room in Building		N

L.R. Kimball notes that the Old Lehman Road site is a 280-foot tower with shelter and generator. Old Stagecoach Rd, Marion Water tower and Mesquite Pass are water towers, approximately 150 feet tall. Courthouse is a rooftop installation at the County Courthouse.

5.7.1.5 Radio Inventory

Guadalupe County provided the following radio equipment information:

Table 127 – Guadalupe County Radio Equipment

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
Old Lehman Rd	Repeater	Motorola	MTR2000	Tx 155.4375 Rx 158.7675
	Repeater	Motorola	MTR2000	Tx 155.985 Rx 154.310
	Receiver	Motorola	MTR2000	Rx 158.790
	Comparator	JPS	Not Specified	Not Specified
	Repeater	Motorola	MTR2000	Tx 155.8275 Rx 158.5500
Old Stagecoach Rd	Repeater	Motorola	MTR2000	Tx 155.9025 Rx 158.790
	Comparator	JPS	Not Specified	Not Specified
Mesquite Pass	Repeater	Motorola	MTR2000	Tx 155.070 Rx 158.940
Marion Water Tower	Receiver	Motorola	MTR2000	Rx 158.7675
	Receiver	Motorola	MTR2000	Rx 158.550

Table 128 – Guadalupe County Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Guadalupe County	Motorola	CDM1250	Mobile	90
	Motorola	HT1000	Portable	30
	Motorola	HT1250	Portable	30
	Motorola	HT750	Portable	40
	Kenwood	TK5710	Mobile	5
	Kenwood	TK5210	Portable	5
McQueeney VFD	ICOM	F-521	Mobile	11
	ICOM	F-3G	Portable	25
	ICOM	F-3011	Portable	2
	Kenwood	NX210	Portable	1
	Kenwood	NX200	Portable	19
New Berlin VFD	Kenwood	TK-780	Mobile	5
	Kenwood	TK-7180	Mobile	5
	Kenwood	TK-2180	Portable	25
	Kenwood	NX700	Mobile	7
	Kenwood	NX200	Portable	5
	Kenwood	NX210	Portable	1

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
	Vertex	VX2500	Mobile	2
	Motorola	HT1000	Portable	2
Lake Dunlap VFD	Vertex	VX-420	Portable	5
	Vertex	VS-180	Portable	5
	Puxing	PX-777	Portable	8
	Midland	LMR	Mobile	1
	Vertex	VX320	Mobile	3
	Motorola	HT1250	Portable	18
Geronimo VFD	Kenwood	NX210	Portable	2
	Motorola	CDM1250	Mobile	4
	Motorola	CDM1550	Mobile	1
	Kenwood	TX-780	Mobile	6
Marion VFD	ICOM	IC-F521	Mobile	1
	Motorola	CDM1250	Mobile	2
	Kenwood	TK-2180	Portable	4
	Kenwood	NX210	Portable	2
	Vertex	VX-180	Portable	25
	Unknown	Unknown	All	30
Total Mobiles				148
Total Portables				279
Total Control Stations				0
Total				427

5.7.1.6 FCC Licenses

Table 129 – Guadalupe County FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WPXW384	1	29-41-15.8	97-54-11.0	155.4375 155.8725	FB2 FB2	106.4 106.4	100 100	150 150	11K2F3E 11K2F3E
	2	29-32-50.8	98-06-53.0	155.9025	FB2	50	100	200	11K2F3E
	3			153.8675 154.1225 158.7675	FX1 FX1 FX1		40 40 40	40 40 40	11K2F3E 11K2F3E 11K2F3E
	4	Countywide		153.8765 154.1225 158.7675	MO MO MO		100 100 100	100 100 100	11K2F3E 11K2F3E 11K2F3E
KB30200	1	10 km radius		155.5500	MO		5	5	11K2F3E

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
		around location 2		155.5500 155.9625 155.9625	MO MO MO		40 5 40	40 5 40	11K2F3E 11K2F3E 11K2F3E
	2	29-36-14.1	97-58-10.6	155.9625	FB2	13	35	60	11K2F3E
WPHW807	1	29-34-06.8	97-57-51.0	158.9100	FB	-2 ²	30	30	20K0F3E
	2	1 km radius around location 1		158.9100	MO		5		20K0F3E
KNAB904	1	Other		154.3100	MO		100		20K0F3E
	2	29-35-25.8	98-02-28.0	154.3100	FB	23	20		20K0F3E
	3	29-36-22.8	98-02-06.0	154.3100	FB		100		20K0F3E
WPRH499	1	29-28-13.4	98-00-54.7	155.0700	FB2	56.4	100	160	20K0F3E
	2	40 km radius around location 1		155.0700 158.9400	MO MO		100 100	100 100	20K0F3E 20K0F3E
	3			158.9400	FX1		40	80	20K0F3E
WPYN367	1	40 km radius around 29-41-19.0	97-54-04.0	159.7800	MO		110	175	20K0F3D, 20K0F3E
				159.8100	MO		110	175	20K0F3D, 20K0F3E
				159.8400	MO		110	175	20K0F3D, 20K0F3E
				160.6500	MO		110	175	20K0F3D, 20K0F3E
				160.1700	MO		110	175	20K0F3D, 20K0F3E
WNUN654	1	29-41-15.8	97-54-11.0	155.9850	FB2		100	100	20K0F3E
	2	Countywide		154.3100	MO		100	100	20K0F3E
				154.7700	MO		100	100	20K0F3E
				460.6375 465.6375	MO MO		2 2	2 2	20K0F3E 20K0F3E
WPRF755	1	29-28-05.8	98-05-51.0	154.490	FB2	18	100	100	20K0F3E
	2	12 km radius around location 1		159.930	MO		100		20K0F3E

² The antenna height shown on the FCC license is "-2.0m." In that on the license, the antenna structure height with and without appurtenances is shown to be 15.0m, and the FCC license for KB30200 at the same location is shown to be 13.0m, it is presumed that the "-2.0m" entry refers to the same height, 13.0m above average terrain.

WPXW384—Call sign WPXW384 is issued to the Guadalupe County SO and covers six VHF frequencies. Two repeater sites, one control station and mobile operation are covered by this license. The frequency pair 155.4375 MHz (TX) and 155.8275 MHz (RX) are used at the repeater site located at 1256 Old Lehman Road in Seguin, and the repeater pair 155.9025 MHz (TX) and 153.8675 MHz (RX) are used at the repeater site located near Stagecoach Road and SH-465 in Marion. These frequency pairs are known as Channel 1 and Channel 2 respectively. The frequency 155.9025 is licensed with the special condition that it is licensed on a secondary basis. The frequencies 154.1225 MHz and 158.7675 MHz are licensed for control station and mobile use. All frequencies covered by this license are licensed for narrowband operation only. Microwave is used for backhaul. Satellite receivers are in use at unknown locations.

KB30200—Call sign KB30200 is issued to the Guadalupe County SO and covers county jail operations. The frequency 155.5500 MHz is utilized primarily for portable operation while the frequency 155.9625 is used for mobile, portable and base operations. The transmitter for 155.9625 MHz is located at 2617 N. Guadalupe Street in Seguin, Texas. The current license covers narrowband operation.

WPHW807—Call sign WPHW807 is issued to the Guadalupe County SO for the frequency 158.910 MHz and is used for courthouse/courtroom security at the Guadalupe County Courthouse located at 101 E. Court Street in Seguin, with the transmitter at the same location. This frequency is licensed for base and portable operation. The existing license covers wideband operation only, and will need to be modified as the equipment used is narrowbanded.

KNAB904—Call sign KNAB904 is issued to the McQueeney VFD for the frequency 154.310 MHz and is used for base and mobile operations. Transmitters are located near FM-78 and FM-725 in McQueeney and at 230 Walnut Drive in the Lake McQueeney Estates area of McQueeney. This license is for wideband emissions only and will need to be updated when equipment used on this frequency is narrowbanded. It should be noted that the FCC license latitude/longitude coordinates locate the site at least several blocks from the street address or intersection provided and should be reviewed for accuracy.

WPRH499—Call sign WPRH499 is issued to the Guadalupe County SO and covers the repeater pair 155.070 MHz (TX) and 158.940 MHz (RX), as well as control station and mobile operation. These frequencies are used by Guadalupe County fire agencies as a south dispatch channel. The license covers wideband operation only and will need to be updated when the equipment in use has been narrowbanded. The repeater for this license is located on a water tank on FM-467 just north of Mesquite Pass Road in Seguin.

WPYN367—Call sign WPYN367 is issued to the Guadalupe County Firefighters Association and covers five VHF mobile-only frequencies used for tactical operations. These frequencies are licensed for wideband operation only and the license will need to be updated when equipment in use on these frequencies has been narrowbanded.

WNUN654—Call sign WNUN654 is issued to the Guadalupe County SO and covers three VHF and two UHF frequencies. One VHF pair is used for repeater operations on 155.985 MHz (TX) with the repeater located near 1256 Old Lehman Road in Seguin. The two UHF frequencies are licensed for portable operation only with a maximum output power of 2 watts. All are licensed for wideband operation only; the license will need to be modified to reflect narrowband operation when all equipment in use on these frequencies has been narrowbanded.

WPRF755—Call sign WPRF755 is issued to the New Berlin VFD and covers a repeater pair on 154.490 MHz (TX) and 159.930 MHz (RX). There is a single site for this repeater. The license is for wideband operation and will need to be updated appropriately when all applicable equipment has been narrowbanded.

5.7.1.7 System Coverage

L.R. Kimball found that radio coverage was indicated to be a major problem within Guadalupe County. User reported coverage is as follows:

Table 130 – Guadalupe County User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	95%
Portable coverage	85%
In-building coverage	Structure dependent

The following coverage map depicts the predicted “talk out” portable coverage for the Guadalupe County law enforcement and fire/EMS channels. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

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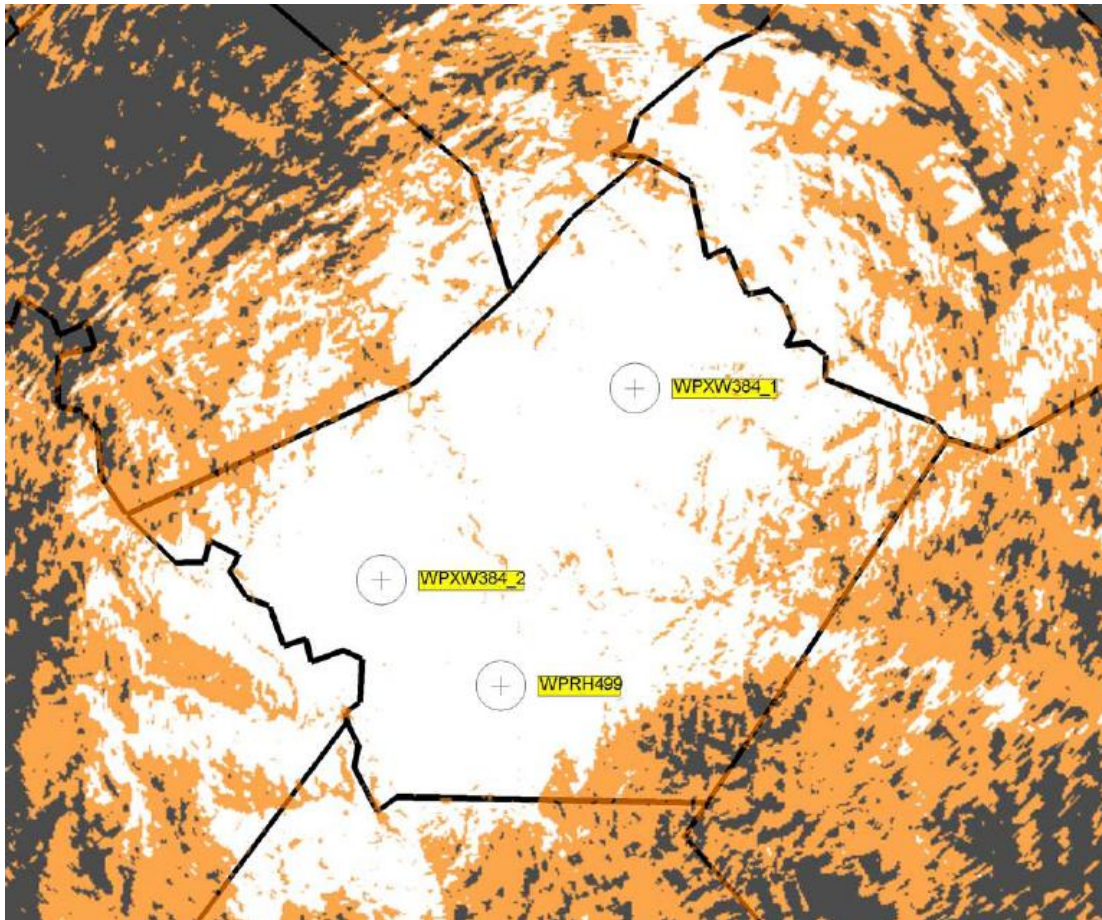


Figure 64 – Predicted Radio Coverage for Guadalupe County

5.7.1.8 Future Plans

Guadalupe County plans to replace the current dispatch console with a full-featured console that will support a patching interface. The County plans to implement a Kenwood NEXEDGE trunking system. The system will initially support the Guadalupe County SO and will be expanded to include all county VFDs. Guadalupe County recognizes that the NEXEDGE platform is proprietary and will not be eligible for grant funding. The County plans to fund the system using local funds. Interoperability will be achieved in a conventional mode and through a gateway system. The County has purchased a P25 repeater for gateway connectivity to P25 VHF systems.

5.7.1.9 Past Expenditures

Guadalupe County provided the following past radio expenditures:

Table 131 – Guadalupe County Past Radio Expenditures

Year	Project Description	Total Cost	Funding Source
All	Radio Installs	\$41,346.79	County Funds
Total		\$41,346.79	

5.7.1.10 Future Funding

Guadalupe County identified the following future funding opportunities:

Table 132 – Guadalupe County Future Funding Sources

Funding Source	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Texas										
PSIC										
IECGP										
AFG										
DHS										
Other County Funds	\$225,000	\$107,000	\$76,000							
Region										
Total	\$225,000	\$107,000	\$76,000							
Total									\$408,000	

5.7.1.11 Assessment

Conventional Architecture—The current Guadalupe county system employs two conventional repeaters for the SO and two conventional repeaters for fire/EMS. While monitoring multiple conventional channels can create an operational problem, four dispatchers should be able to sufficiently manage the traffic. The problem is alleviated by the use of voted receivers, which expand the coverage area in each site. By greatly improving “talk back” coverage, it is likely that a call will be received from a remote unit on a channel outside the coverage area of the transmitter. In this case, dispatchers must make use of the simulselect option to transmit from both transmitter locations for each discipline to ensure communications are maintained. If coverage issues are addressed through the addition of conventional repeaters, operational difficulty will increase for users and dispatchers.

Non-public safety-grade Radios—Based upon the radio inventory provided by Guadalupe County, subscriber radios utilized are not designed to meet the quality and reliability needed for public safety communications. While these radios provide adequate features to meet the needs of Guadalupe County, reliability is a major concern. It is understood that the radios utilized by Guadalupe County are significantly less expensive than public safety-grade radios; however, these radios are far more prone to failures. With regard to radio features, the models utilized by

Guadalupe County are narrowbanding compliant, but will not meet the State's requirement for P25 operation. They will not support trunking architecture should one be implemented within Guadalupe County.

Coverage—Coverage is the most essential feature of any radio system. Radio system user feedback indicated that the present radio system provides approximately 85 percent outdoor portable coverage and 95 percent mobile coverage. While this level of coverage may be adequate for some rural agencies, typical coverage requirements for a countywide system are above 95 percent portable coverage. A first responder is at a great risk any time they need to respond to an incident outside of radio coverage. For fire/EMS, indoor coverage is especially critical. While simplex frequencies can be used to coordinate an event on-scene while outside of the system coverage area, radio coverage is necessary for calls for backup and to coordinate with other users.

Interoperability—Guadalupe County indicated numerous interoperability gaps with surrounding jurisdictions, including limited connectivity to Schertz PD, Cibolo PD, Marion PD, Seguin FD, Schertz EMS, Seguin EMS, TXDPS and game wardens. These limitations were indicated to be a combination of disparate frequency bands, improper channel programming, lack of SOPs, and lack of cooperation.

NEXEDGE—Guadalupe County plans to implement a Kenwood NEXEDGE system utilizing the proprietary NXDN platform. The system will utilize TDMA to provide two talk paths for every VHF frequency, and data capabilities. L.R. Kimball notes that while NEXEDGE is a digital technology, the platform is proprietary to specific Kenwood subscriber radios. Interoperability will be impeded, resulting from the lack of neighboring jurisdictions having the ability to access the Guadalupe County system. Interoperability may be achieved in a conventional mode between Guadalupe County and neighboring VHF primary jurisdictions.

5.7.2 Radio System—City of Cibolo

5.7.2.1 System Description

The Cibolo radio system serves Cibolo PD, FD and Public Works. All Cibolo users are on VHF frequencies. The Cibolo FD system has three sites operating in simplex, while the Cibolo PD has one repeated site. The city of Cibolo is dispatched by the Schertz PSAP.

L.R. Kimball was unable to survey representatives from the city of Cibolo. The information provided in the section is based upon estimates, FCC license information, and limited information obtained during a meeting with

5.7.2.2 User Agencies

The following agencies/entities utilize the Cibolo radio system:

Table 133 – Cibolo User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Cibolo PD	Law Enforcement			
Cibolo FD	Fire/EMS			

5.7.2.3 Dispatch Facilities

The Cibolo PD and FD are dispatched by the city of Schertz.

5.7.2.4 Focus Groups

Cibolo did not provide feedback on the radio system.

5.7.2.5 Radio Sites

L.R Kimball gathered the following radio site information:

Table 134 – Cibolo Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Cibolo Water Tank	Water Tank on Cibolo Valley Drive, Cibolo, TX	City of Cibolo	Unknown	Unknown

L.R Kimball gathered the following radio shelter information:

Table 135 – Cibolo Radio Shelters

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Cibolo Water Tank	Unknown	Unknown	Unknown	Unknown

5.7.2.6 Radio Inventory

Cibolo provided the following radio inventory:

Table 136 – Cibolo Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Cibolo PD	Unknown	Unknown	Unknown	~25
Cibolo FD	Unknown	Unknown	Unknown	~25
Total Portables				
Total Mobiles				
Total Control Stations				
Total				50

5.7.2.7 FCC Licenses

Table 137 – Cibolo FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WNHU792	1	29-35-04.1	98-14-47.6	159.060	FB	48	50	89	20K0F3E
	2	29-33-38.8	98-13-38.0	159.060	FB	12	50	89	20K0F3E
	3	29-33-22.8	98-18-27.0	159.060	FB	11	60	110	20K0F3E
	4	8 km radius around location 1		159.060	MO		100		20K0F3E
	5	29-35-51.7	98-15-20.7	159.060	FB2	66	100	100	20K0F3E, 11K2F3E
	6	40 km radius around location 5		151.1975 151.1975 159.0600 159.0600	MO MO MO MO		100 5 100 5	100 5 100 5	11K2F3E 11K2F3E 20K0F3E, 11K2F3E 20K0F3E, 11K2F3E
WNME760	1	29-36-42.6	98-15-08.8	159.120	FB2	39	60	106	20K0F3E
	2	29-33-52.8	98-16-11.0	159.120	FX1	43	10	10	20K0F3E
	3	20 km radius around location 1		156.120 156.120 159.120	MO MO MO		5 60 60	5 60 53	20K0F3E 20K0F3E 20K0F3E

WNHU792—Call sign WNHU792 is issued to the city of Cibolo and is used for fire dispatch by Schertz. There are four sites on this license, with one repeated pair using 159.060 MHz (TX) and 151.1975 MHz (RX). The repeater pair is licensed for both narrowband and wideband operation for a single repeater site and mobile use. Sites five and six are licensed for both narrowband and wideband emissions; sites one through four are licensed for wideband operation only. This license will need to be updated appropriately when all applicable equipment has been narrowbanded.

WNME760—Call sign WNME760 is issued to the city of Schertz and the licensed frequencies are used to dispatch the Cibolo PD. This license covers a repeater pair on 159.120 MHz (TX) and 156.120 MHz (RX) operating on a single repeater site. This license is for wideband only and will need to be modified for narrowband operation once all applicable equipment has been narrowbanded.

5.7.2.8 System Coverage

Coverage levels were not reported

The following coverage map depicts the predicted “talk out” portable coverage for the Cibolo repeater channel. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

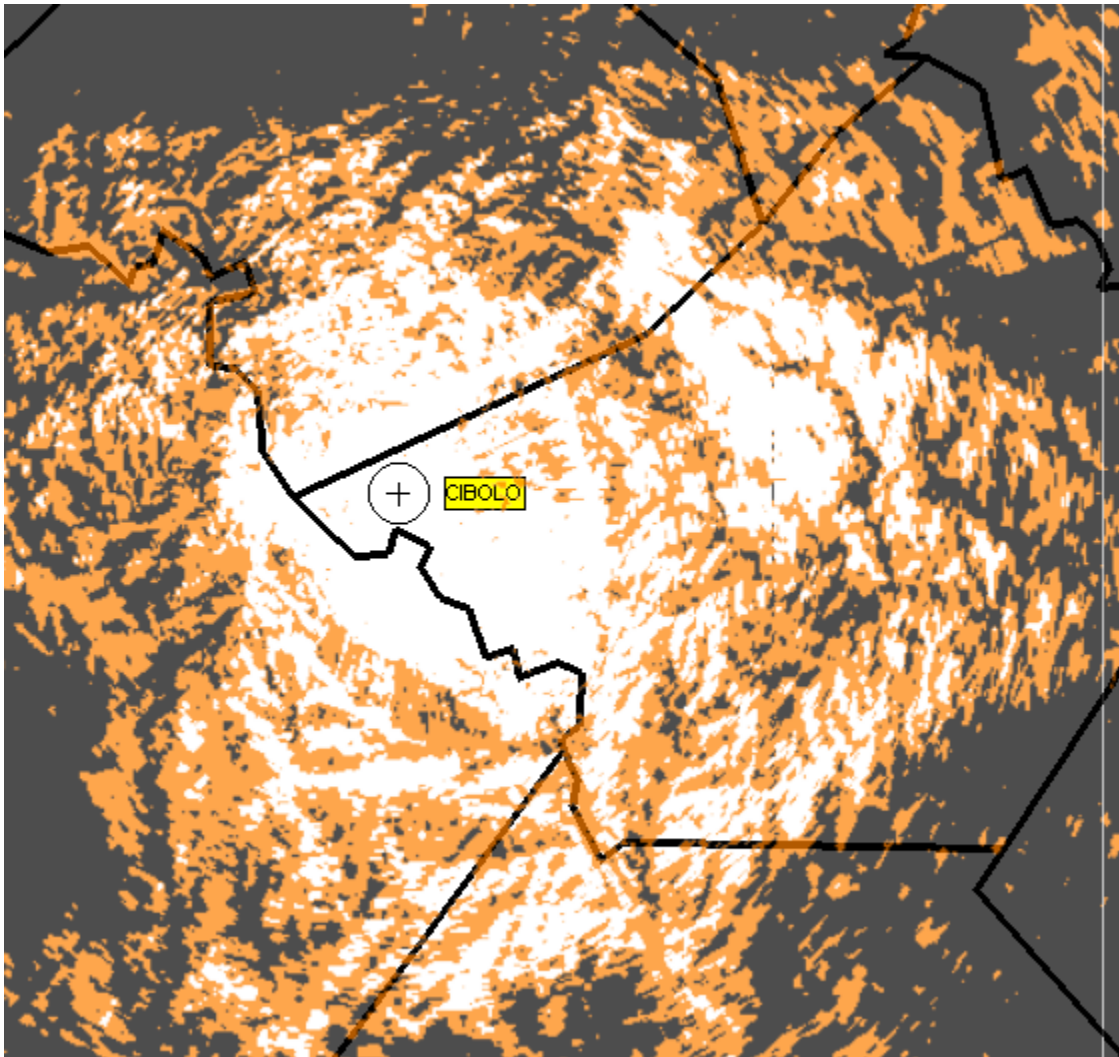


Figure 65 – Predicted Radio Coverage for Cibola

5.7.2.9 Future Plans

Cibola indicated plans to purchase multi-band APX radios capable of operating in the conventional and P25 trunking modes. The city's geographic location is between the COSA/Bexar County 800 MHz system, the regional 700 MHz system, the Comal County VHF trunking system, and the Guadalupe County NEXEDGE system. Cibola plans to utilize the radios as an interoperability tool to communicate with all neighboring systems and as an upgrade path until the point where Cibola can decide on which trunking system they will ultimately utilize for primary operations.

5.7.2.10 Past Expenditures

Cibolo did not provide past radio expenditures.

5.7.2.11 Future Funding

Cibolo did not identify future funding opportunities.

5.7.2.12 Assessment

There was not enough information for L.R. Kimball to provide an adequate assessment of the Cibolo radio system. L.R. Kimball agrees with the plan indicated by Cibolo representatives to purchase multi-band radios with the ultimate goal of migrating to one of the regional P25 trunking systems.

5.7.3 Radio System—City of Schertz

The city of Schertz operates on the 800 MHz Live Oak system and on a VHF conventional system. One VHF repeater is utilized by fire/EMS and one VHF repeater is utilized by the PD. (For additional information regarding the Live Oak system, refer to the Bexar County section.) 800 MHz equipment is manufactured by Harris and VHF equipment is manufactured by Motorola. Users and vehicles carry both VHF and 800 MHz radios for operation on both of the systems.

5.7.3.1 User Agencies

The following agencies/entities utilize the Schertz radio system:

Table 138 – Schertz User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Schertz PD	Law Enforcement			
Schertz FD	Fire			
Schertz EMS	EMS			
Cibolo PD (VHF)	Law Enforcement			
Cibolo FD (VHF)	Fire			

5.7.3.2 Dispatch Facilities

Schertz has its own dispatch facility and dispatches for the Schertz PD and FD, and the Cibolo PD and FD. The dispatch center is located at the Schertz PD, 1400 Schertz Parkway, Building 6, in Schertz. The center operates a total of three dispatch console positions. Dispatch consoles were provided by Dailey Wells. Dispatch for law enforcement is performed on the 800 MHz Live Oak system and dispatch for fire/EMS is performed on the VHF system. The dispatch console utilizes control station interfaces with the VHF and 800 MHz repeaters.

Channels appearing on the console include:

Table 139 – Schertz Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Police 1	PD Dispatch + Primary Comm
ACO	Animal Control Primary
Fire 1	FD Primary Response
EMS 1	EMS Primary Response
Wide Area	Selectable M7100 Radio
Pub Works	PW Primary (UHF)
Cibolo Fire	Cibolo FD Dispatch + Ops (VHF)
FD/EMS	FD/EMS Dispatch (VHF)

5.7.3.3 Focus Groups

The following are key points documented by L.R. Kimball based upon information provided by the city of Schertz:

Coverage—Serious coverage problems were reported on the Live Oak system. User feedback indicates that one additional transmitter location is likely necessary to provide adequate coverage for Schertz.

Interoperability—Interoperability gaps were identified with Randolph AFB fire and law enforcement. Interoperability is achieved with neighboring jurisdictions on shared primary channels or interoperability channels.

5.7.3.4 Radio Sites

Schertz provided the following radio site information:

Table 140 – Schertz Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Schertz PD	1400 Schertz Pkwy	City of Schertz	25 Years	N
Naco Well (Fire/EMS VHF Repeater)	19625 FM 3009	City of Schertz	25	Y
IH 35 (PD VHF Repeater)	2300 Tulip Lane	City of Schertz	5	Y

Schertz provided the following radio shelter information:

Table 141 – Schertz Radio Shelters

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Naco Well	8' x 8'	Concrete Block	2010	Y
IH 35	Enclosed Base of Water Tower	Concrete	2005	N

5.7.3.5 Radio Inventory

Schertz provided the following radio equipment information:

Table 142 – Schertz Fixed Radio Equipment

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
Schertz PD	Base Station	Multiple	Multiple	VHF/UHF/800
Fire Station 1	Base Station	Motorola/Harris	CDM1550/M7100	VHF/800
Fire Station 2	Base Station	Motorola/Harris	CDM1550/M7100	VHF/800
EMS Station 1	Base Station	Motorola/Harris	CDM1550/M7100	VHF/800
EMS Station 2	Base Station	Motorola/Harris	CDM1550/M7100	VHF/800
EMS Station 4	Base Station	Motorola/Harris	CDM1550/M7100	VHF/800
Public Works	Base Station			UHF
Naco Site	Repeater	Motorola		153.435 / 156.015
IH 35 Site	Repeater	E.F. Johnson		156.120 / 159.120

Table 143 – Schertz Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
City of Schertz	Harris	P7100	Portable	56
	Harris	P5400	Portable	3
	Harris	M7100	Mobile	33
	Harris	M7100	Control Station	5
	Motorola	HT1250	Portable	30
	Motorola	CDM1250	Mobile	15
	Motorola	CDM1550	Mobile	5
Total Mobiles				53
Total Portables				89

Total Control Stations	5
Total	147

5.7.3.6 FCC Licenses

Table 144 – Schertz FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WNME760	1	29-36-42.6	98-15-8.8	159.1200	FB2	39	60	106	11K3F3E 20K0F3E
	2	29-33-52.8	98-16-11	159.1200	FX1	43	10	10	11K3F3E 20K0F3E
	3	20 km around location 1		156.1200 156.1200 159.1200	MO		5 60 60	5 53 53	11K3F3E 20K0F3E
KXA372	1	6.1 m control stations		153.9350	FX1		35		11K3F3E 20K0F3E
	2	29-33-52.8	98-16-11	156.0150	FB	49	35		11K3F3E 20K0F3E
	3	40 MIRA GARDEN RIDGE TX		153.9350	MO		50		11K3F3E 20K0F3E
	4	29-37-27.8	98-17-28	156.0150	FB	60	90		11K3F3E 20K0F3E

WNME760—Call sign WNME760 is licensed by the city of Schertz and covers VHF repeater operations for the Schertz PD. The control station frequency is inappropriately licensed on the repeater base frequency instead of the mobile frequency. A separate mobile line is licensed for portable operation, which is not necessary. The license reflects narrowband operation.

KXA372—Call sign KXA372 is licensed by the city of Schertz and covers the operation of two simplex stations in the Schertz and Garden Ridge areas. The base station frequency is indicated by Schertz to be the primary fire repeater frequency; however, the license does not reflect repeater operation. Control stations and mobiles indicate that the 1400 Live Oak Road site should be licensed with the DB2 station class. Control station operation is covered; however, mobile talkaround is not covered. The license reflects narrowband operation.

5.7.3.7 System Coverage

Schertz did not provide radio system cover L.R. Kimball found that radio coverage was indicated to be a major problem within the city of Schertz. User feedback indicates that one additional 800 MHz site is necessary to provide adequate coverage. User reported coverage is as follows:

Table 145 – Schertz User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	90%
Portable coverage	80%
In-building coverage	75%

Coverage estimates for the 800 MHz system are provided in the Live Oak section.

5.7.3.8 Future Plans

Future plans include adding at least one additional tower site in a simulcast configuration to improve 800 MHz coverage in eastern parts of the jurisdiction. Plans for the additional radio site have not been funded.

5.7.3.9 Past Expenditures

Schertz provided the following past radio expenditures:

Table 146 – Schertz Past Radio Expenditures

Year	Project Description	Total Cost	Funding Source
2008	Initial Acquisition and installation of radios and Equipment for 800 MHz System	\$695,883	Local Funds (Bonds)
2007	Purchase of 2 MSAST G2 Comm Units	\$17,742	2005 LETPP + General Fund
2007	ACU1000 Gateway and 4 Mobile Radios (VHF/UHF/800)	\$12,341	2006 LETPP
2007	Additional 800 MHz Radios	\$3,778	General Fund
2008	Additional 800 MHz Radios	\$58,079	General Fund
2009	Additional 800 MHz Radios	\$13,892	General Fund
2010	NCS 250 Mobile Gateway and UHF Radio	\$3,470	General Fund
Total		\$805,185	

5.7.3.10 Future Funding

Schertz did not identify future funding opportunities.

5.7.3.11 Assessment

Coverage—Serious coverage problems were reported by Schertz in eastern parts of the jurisdiction. Coverage is supplemented utilizing the VHF radio system; however, this method of communication creates operational challenges. VHF channels are gateway connected to the 800 MHz system so that VHF traffic can be received by 800 MHz users. While long-term goals include implementing an additional tower site to expand coverage on the system, no firm plans exist and the project has not yet been funded.

Interoperability—Interoperability gaps were identified specifically with Randolph AFB. Primary interoperability is accomplished utilizing shared channels and gateways. With both VHF and 800 MHz radios, Schertz radio users have the capability to communicate with most neighboring jurisdictions.

P25—While no plans are currently in place to migrate the Live Oak radio system to P25, a migration is anticipated within the next five years. All of the subscriber radios purchased by the city of Schertz are capable of operating in the P25 mode, but will require software upgrades in the amount of approximately \$700 per radio to add P25 trunking features.

5.7.4 Radio System—City of Seguin

5.7.4.1 System Description

The Seguin radio system is utilized by the Seguin PD and FD. The City operates in the VHF band utilizing mixed mode narrowband analog and P25 conventional repeaters. Two repeater channels are utilized by the PD: one channel for dispatch and one channel for tactical operations. A third tactical repeater channel is maintained at an alternate radio site. The FD utilizes a primary repeater channel for dispatch operations and a simplex channel for fire ground operations. A backup fire repeater is located at the alternate radio site. Separate repeater channels are utilized by the public works and utilities departments. Subscriber equipment and fixed infrastructure is primarily manufactured by Motorola. The current mixed mode conventional system was installed in 2006. Motorola proprietary ADP encryption is utilized.

VHF wideband and narrowband interoperability channels are programmed into all Seguin subscriber radios. A mobile gateway is operated by Seguin with patching capabilities for VHF, UHF, and 800 MHz systems.

5.7.4.2 User Agencies

The following agencies/entities utilize the Seguin radio system:

Table 147 – Seguin User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Seguin PD	Law Enforcement	Cynthia Rangel	830-401-2345	crangel@seguintexas.gov
Seguin Fire/EMS	Fire/EMS	Gregg Dreiss	830-401-2312	gdreiss@seguintexas.gov
Seguin Utilities	City Utilities	William Bisette	830-401-2405	wbisette@seguintexas.gov
Seguin Public Works	City Public Works	Ruben Perez	830-401-2349	rperez@seguintexas.gov

5.7.4.3 Dispatch Facilities

The Seguin dispatch center is located at the Seguin PD, 350 N. Guadalupe Street, Seguin. The dispatch center includes five MCC5500 dispatch consoles. The consoles are full-featured LCD consoles that support patching capabilities. The dispatch consoles utilize a control station interface to receive audio from the primary Sprint and Housing Authority towers. An on-site radio tower at the PD is mounted with control station antennas that are connected to the dispatch consoles.

Channels appearing on the console include:

Table 148 – Seguin Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Police Main	Police Primary Dispatch
PD Tac 1	Police Tactical
PD Tac 2	Police Tactical
SWAT	Police Tactical
Fire Main	Fire Primary Dispatch
Fire Backup	Fire Backup
Fire Tac 1	Fire Tactical
Public Works	City Public Works Dispatch
Utilities	City Utilities Dispatch
TX Law1	Police Mutual Aid
TX Law2	Police Mutual Aid
Guadalupe County SO 1	Sheriffs Primary Dispatch
SO 2	Sheriffs Primary Dispatch
Guadalupe County Fire	Volunteer Fire Primary

5.7.4.4 Focus Groups

The following are key points documented by L.R. Kimball regarding information provided by Seguin:

Coverage and Capacity—Coverage and capacity on the present system were not reported to be problematic.

Interoperability—Interoperability gaps were identified with New Braunfels and the Comal County SO. Interoperability gaps are a result of a lack of shared channel programming.

5.7.4.5 Radio Sites

Seguin provided the following radio site information:

Table 149 – Seguin Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Sprint Tower	410 N. Camp, Seguin, TX 78155	Sprint	5 Years	N/A
Seguin Housing Authority		Seguin Housing Authority	Equipment Installed 5 years ago	Y
PD	350 N. Guadalupe, Seguin, TX 78155	City of Seguin	5 Years	Y

Seguin provided the following radio shelter information:

Table 150 – Seguin Radio Shelters

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Sprint Tower		Concrete	2006	
Seguin Housing Authority		Concrete	Installed equipment 2006	
PD		Concrete	2006	

5.7.4.6 Radio Inventory

Seguin provided the following radio equipment information:

Table 151 – Seguin Fixed Radio Equipment

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
Sprint Tower	Repeater PD Tac1	Motorola	C99ED0001C	155.520/157.665
Sprint Tower	Repeater Pub Wks	Motorola	C99ED0001C	155.940/153.590
Sprint Tower	Repeater Utilities	Motorola	C99ED0001C	154.8525/151.280
Sprint Tower	Base County Fire	Motorola	C99ED0001C	154.310/154.310
Sprint Tower	Base TX Law 2	Motorola	C99ED0001C	155.370/
Sprint Tower	Receiver SWAT	Motorola	T5367	158.955
Sprint Tower	Receiver Fire Ground1	Motorola	T5367	158.8425
Jefferson Site	Repeater PD Tac2	Motorola	C99ED0001C	152.405/153.7925
Jefferson Site	Repeater Fire BU	Motorola	C99ED0001C	155.715/153.860

Sequin did not provide subscriber equipment information. The following table includes subscriber estimates identified by L.R. Kimball:

Table 152 – Sequin Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Sequin PD/Fire/EMS	Motorola	VHF P25 Conventional	All	120
Total Mobiles				
Total Portables				
Total Control Stations				
Total				120

5.7.4.7 FCC Licenses

Table 153 – Sequin FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WQGI741	1	29-34-18.1	97-57-58.4	154.4300	FB	63.7	100	100	11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
				154.4300	FB2	63.7	100	100	11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
				154.7850	FB2	63.7	100	250	11K3F2E, 11K3F3E, 20K0F3E, 8K10F1D, 8K10F1E
				154.8525	FB2	50.9	100	250	11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
				155.5200	FB2	38.7	100	250	11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
				155.9400	FB2	50.9	100	250	11K3F2E, 11K3F3E, 20K0F3E, 8K10F1D, 8K10F1E

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
	2	29-33-59.7	97-58-11.8	155.7150	FB2	50.3	100	250	11K3F2E, 11K3F3E, 20K0F3E, 8K10F1D, 8K10F1E
	3			151.2800	FX1	12.2	25	100	11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
				153.7925	FX1	12.2	25	100	11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
				153.8600	FX1	12.2	25	100	11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
				155.3700	FB	15.2	100	250	20K0F3E, 8K10F1D, 8K10F1E
				155.7525	FB	15.2	100	250	11K0F3E, 8K10F1D, 8K10F1E
				156.0300	FX1	12.2	25	100	11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
				156.2100	FX1	12.2	25	100	11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
	4	32 km radius around location 1		151.2800	MO				11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
				151.2800	MO				11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
				153.7925	MO				11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
				153.7925	MO				11K3F2E, 11K3F3E,

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
				153.8600	MO				8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 20K0F3E,
				153.8600	MO				8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 20K0F3E,
				154.9500	MO				8K10F1D, 8K10F1E, 20K0F3E, 8K10F1D, 8K10F1E,
				154.9500	MO				20K0F3E, 8K10F1D, 8K10F1E, 20K0F3E, 8K10F1D, 8K10F1E,
				155.7525	MO				20K0F3E, 8K10F1D, 8K10F1E, 20K0F3E, 8K10F1D, 8K10F1E,
				155.7525	MO				20K0F3E, 8K10F1D, 8K10F1E, 20K0F3E, 8K10F1D, 8K10F1E,
				156.0300	MO				11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E,
				156.0300	MO				8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 20K0F3E, 8K10F1D, 8K10F1E,
				156.2100	MO				11K3F2E, 11K3F3E, 20K0F3E, 8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E,
				156.2100	MO				20K0F3E, 8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 20K0F3E, 8K10F1D, 8K10F1E,
	5			151.2800	FX1		25	100	11K3F2E, 11K3F3E, 20K0F3E,

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
				153.7925	FX1		25	100	8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 20K0F3E, 8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
				153.8600	FX1		25	100	11K3F2E, 11K3F3E, 20K0F3E, 8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
				156.0300	FX1		25	100	11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
				156.2100	FX1		25	100	11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E, 11K3F2E, 11K3F3E, 8K10F1D, 8K10F1E
	6	64 km radius around 29-34-21.8	97-57-28.0	155.7150	MO		100	100	20K0F3E, 8K10F1D, 8K10F1E
	7	16 km radius around 29-34-57.8	97-56-51.0	154.0925	MO		50	50	11K2F3E, 8K10F1D, 8K10F1E
				155.3925	MO		50	50	11K2F3E, 8K10F1D, 8K10F1E
				158.9550	MO		100	100	20K0F3E, 8K10F1D, 8K10F1E
	8	Countywide		154.8425	MO		100	250	11K2F3E, 8K10F1D, 8K10F1E

WQGI741—Call sign WQGI741 is licensed by the city of Seguin and covers primary repeater operations for the Seguin PD and FD. The license includes a total of five repeater frequencies at the Sprint Tower and one repeater frequency at the Housing Authority tower. The Sprint Tower channels are used for PD dispatch, PD tactical, FD dispatch, utilities, and public works. The Housing Authority channel is the fire backup channel. Simplex operation is covered on TXLAW2 and VCALL. The call sign covers control station operation, but does not cover mobile only talkaround. Emission designators reflect P25 Phase I operation.

5.7.4.8 System Coverage

Coverage was not reported as a problem on the Seguin system. One additional tower site was reported as needed to meet coverage needs. User reported coverage is as follows:

Table 154 – Seguin User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	99%
Portable coverage	75%
In-building coverage	65%

The following coverage map depicts the predicted “talk out” portable coverage for the Seguin law enforcement and fire/EMS channels. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

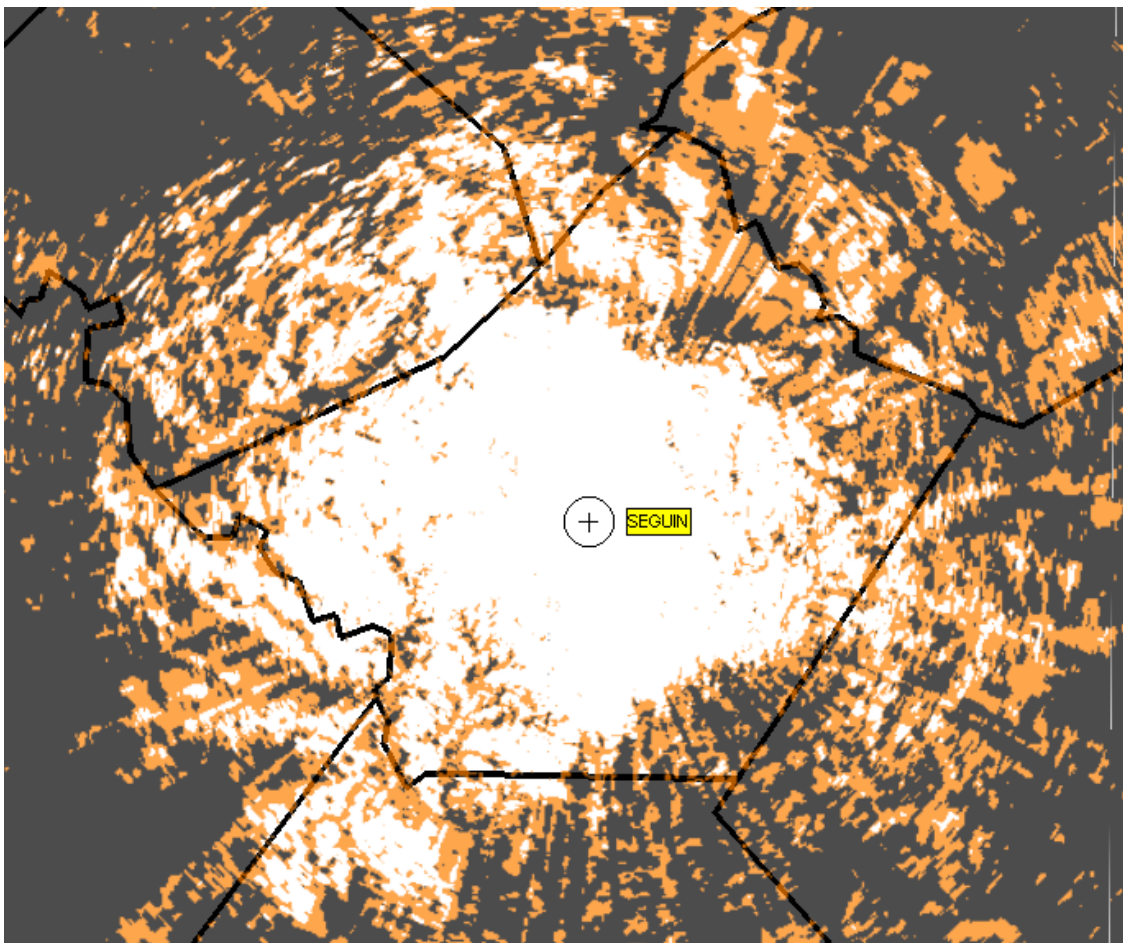


Figure 66 – Predicted Radio Coverage for Seguin

Propagation studies indicate that coverage on the primary Seguin tower is excellent through much of Guadalupe County. Portable in-street and in-building coverage should be sufficient within the Seguin city limits. Coverage estimates agree with user reported levels.

5.7.4.9 Future Plans

Seguin did not provide any immediate plans for the trunking system. Seguin indicated desires to move toward trunking architecture in the long-term; however, no plans for a migration have been discussed. The present system meets coverage and capacity needs for the City.

5.7.4.10 Past Expenditures

Seguin did not provide past radio expenditures.

5.7.4.11 Future Funding

Seguin identified the following future funding opportunities:

Table 155 – Seguin Future Funding Sources

Funding Source	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Texas										
PSIC										
IECGP										
AFG										
DHS	\$60,000	\$20,000	\$75,000							
Other										
Region										
Total	\$60,000	\$20,000	\$75,000							
Total									\$155,000	

5.7.4.12 Assessment

Interoperability—Several interoperability gaps were identified between Seguin and neighboring VHF jurisdictions. These gaps present a concern that can be easily rectified through the programming of shared channels. While the dispatch consoles have patching capabilities, no coverage footprint exists within the Seguin area for 800 MHz users. In the event of a major disaster, it is likely that first responders from San Antonio or the Live Oak area may respond to Seguin. No connectivity currently exists to provide immediate interoperability. Connectivity can only be achieved through the deployment of the mobile command vehicle, which will only provide a limited coverage footprint. Plans of Guadalupe County to migrate to a NEXEDGE system will complicate interoperability as Seguin users will no longer be able to access primary Guadalupe County channels. Patching will be necessary, and connectivity for Seguin will be limited to the primary repeater footprint or to conventional simplex channels.

5.8 Karnes County

Karnes County, with an estimated 2009 population of 15,029, is located in the southeastern portion of the AACOG. The county is 754 square miles, of which 3 square miles is water. Towns and cities throughout the county include Cestohowa, Ecletto, Falls City, Gillett, Helena, Hobson, Karnes City, Kenedy, Panna Maria, Runge and Wintergreen.

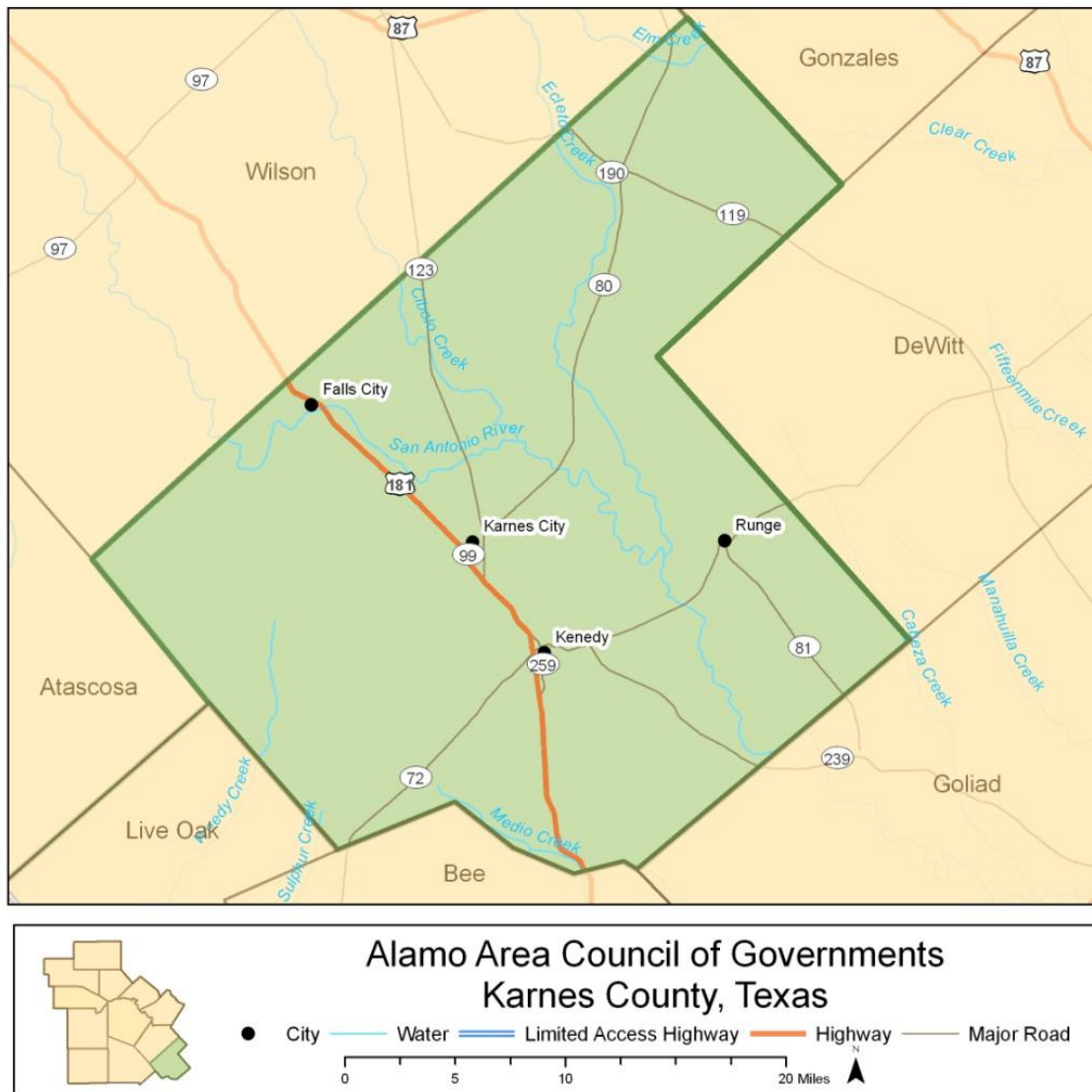


Figure 67 – Karnes County

Through the interview and assessment process, L.R. Kimball found that Karnes County uses a single VHF conventional system, which utilizes satellite receivers to provide radio service for all public safety disciplines within the county.

5.8.1 Radio System—Karnes County

The Karnes County system utilizes a single VHF narrowband analog repeater to provide dispatch services for law enforcement, fire and EMS users within the county. Satellite receivers are utilized to enhance “talk back” coverage. Two simplex channels are utilized for tactical operations for public safety disciplines. TXLAW1 and TXLAW2 are monitored at the dispatch console. The system was initially installed in 1970, although all radio equipment has subsequently been replaced and is now all narrowband capable. Base station equipment is Motorola and subscriber equipment is of various manufacturers.

5.8.1.1 User Agencies

The following agencies/entities utilize the Karnes County radio system:

Table 156 – Karnes County User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Karnes County SO	Law Enforcement	Not Specified	Not Specified	Not Specified
Karnes City PD	Law Enforcement	Not Specified	Not Specified	Not Specified
Karnes County Fire	Fire	Not Specified	Not Specified	Not Specified
Karnes County EMS	EMS	Not Specified	Not Specified	Not Specified
City of Runge	Law Enforcement	Not Specified	Not Specified	Not Specified
City of Kennedy	Law Enforcement	Not Specified	Not Specified	Not Specified
Falls City	Law Enforcement	Not Specified	Not Specified	Not Specified
State	Law Enforcement	Not Specified	Not Specified	Not Specified

5.8.1.2 Dispatch Facilities

The dispatch center is located at the Karnes County SO, 101 North Panna Maria Avenue, in Karnes City.

Channels appearing on the console include:

Table 157 – Karnes County Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Karnes Primary	LE, Fire, and EMS dispatch
Karnes 2	Operational Channel
Texas Car to Car	LE TAC

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Inter City	Not Specified
School Channel	Contact with 4 schools
Karnes LE	LE ops channel

5.8.1.3 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

Coverage—Radio coverage was indicated to be a major problem with the current system, with portable coverage covering approximately 80 percent of the county. User feedback indicates that approximately two additional VHF repeaters would be necessary to provide adequate coverage for the system.

Channel Capacity—Channel capacity was indicated to be a problem with the system when multiple events occur simultaneously. Currently, all public safety disciplines share a single dispatch channel. User feedback indicates one additional channel for each agency is needed.

Interoperability—Communications within Karnes County are primarily internal; however, mutual aid communications with San Antonio and Bexar County is likely in the event of a major disaster. Currently, no mechanism exists to patch incoming 800 MHz users from Bexar County to VHF primary users in Karnes County.

5.8.1.4 Radio Sites

Karnes County provided the following radio site information:

Table 158 – Karnes County Radio Site

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
SO	113 N. Panna Maria Street Karnes City, TX	Same	Unknown	Unknown

Karnes County did not provide radio shelter information.

The remainder of this page intentionally left blank.

5.8.1.5 Radio Inventory

Karnes County provided the following radio equipment information:

Table 159 – Karnes County Radio Equipment

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
SO	Base	Motorola	MTR2000	154.875 TX 155.850 RX

Table 160 – Karnes County Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
LE	Various	Various	Portable and Mobile	50
Fire	Various	Various	Portable and Mobile	40
EMS	Various	Various	Portable and Mobile	5
Wrecker Service	Various	Various	Portable and Mobile	2
EOC	Various	Various	Portable and Mobile	5
Total Mobiles				
Total Portables				
Total Control Stations				
Total				102

5.8.1.6 System Coverage

User reported coverage is as follows:

Table 161 – Karnes County User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	90%
Portable coverage	80%
In-building coverage	70%

The following coverage map depicts the predicted “talk out” portable coverage for the Karnes County radio system. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

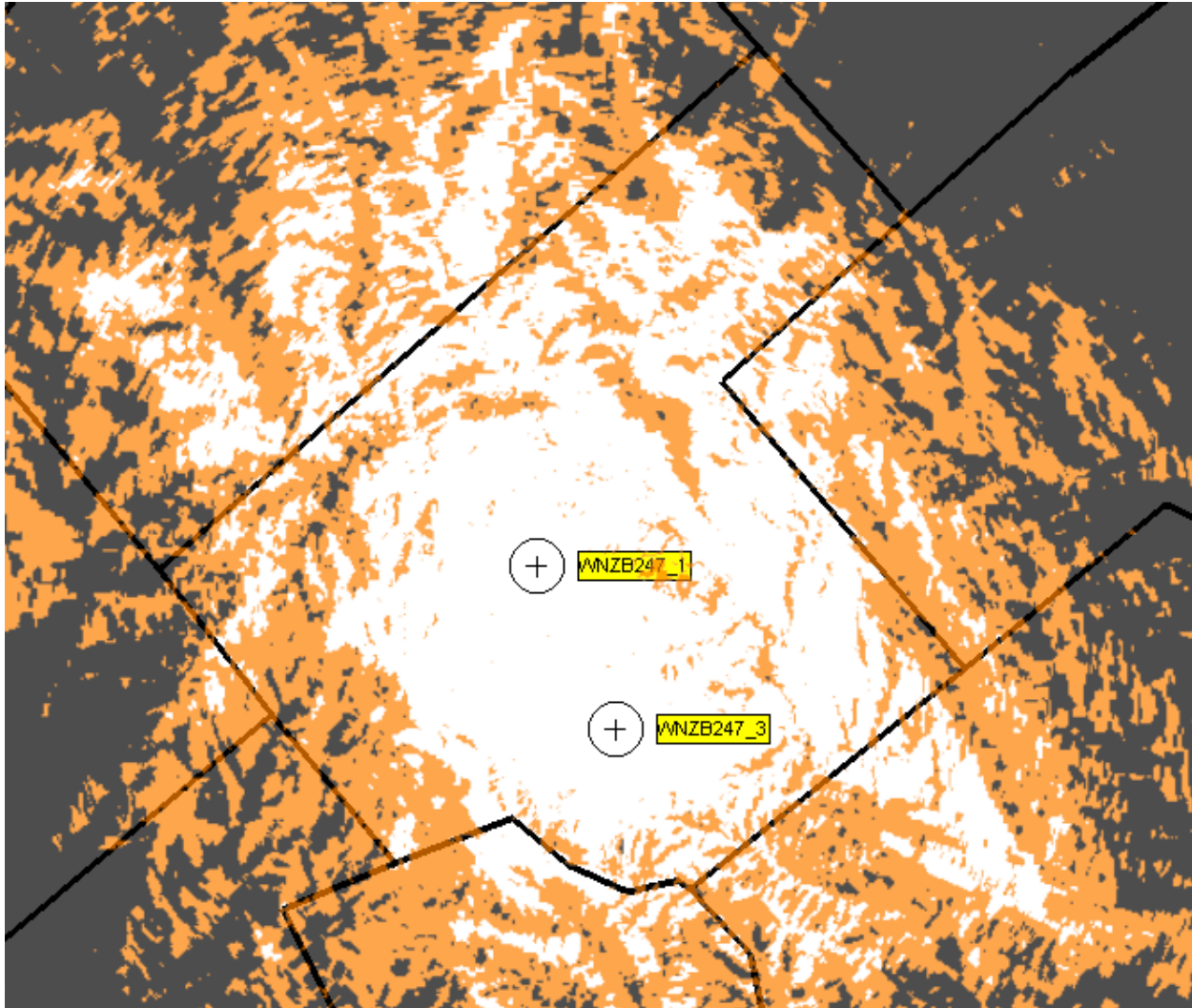


Figure 68 – Predicted Radio Coverage for Karnes County

5.8.1.7 Future Plans

Karnes County indicated the following future plans:

- Replacing the current radio console with a Zetron model console in 2010 that will support additional channels and patching capabilities
- Installing a dispatch console at the EOC in Kennedy
- Obtaining a grant for an additional P25 repeater

5.8.1.8 Past Expenditures

Karnes County provided the following past radio expenditures:

Table 162 – Karnes County Past Radio Expenditures

Year	Project Description	Total Cost	Funding Source
2010	New Portables and Mobiles	\$81,000	421 funding from Gov Office
2009	Re-install Inner city car to car frequency	\$15,000	421 funding from Gov Office
2009	P25 Digital Channel	\$25,000	HLS
2007	Purchase portables for LE	\$20,000	HLS
2010	Radio Consoles	\$53,000	HLS
Total		\$194,000	

5.8.1.9 Future Funding

Karnes County did not identify future funding opportunities.

5.8.1.10 Assessment

Coverage—Coverage is the most essential feature of any radio system. User feedback indicated that the present radio system provides approximately 80 percent outdoor portable coverage and 90 percent mobile coverage. While this level of coverage may be adequate for some rural agencies, typical coverage requirements for a countywide system are above 95 percent portable. A first responder is at a great risk any time they need to respond to an incident outside of radio coverage. For fire/EMS, indoor coverage is especially critical. While simplex frequencies can be used to coordinate an event on-scene while outside of the system coverage area, radio coverage is necessary for calls for backup and to coordinate with other users.

Reliability—Currently, radio system operation depends solely on the use of a single conventional repeater for dispatch, with backup simplex equipment co-located at the SO. Locating all equipment at a single site creates the potential for a complete system failure. Such an outage could result from a well-placed lightning strike or backup power failure during a power outage. If communications are going to depend on a single radio site, then site construction consistent with R56 or equivalent grounding standards and regular preventive site maintenance is a must.

Capacity—Capacity on a radio system to accommodate multiple incidents is a must. Utilizing a single radio channel for all public safety disciplines creates the potential for ineffective communications when multiple events occur. In addition, a single channel is virtually impossible to manage during a large-scale interoperability event.

Interoperability—To achieve interoperability, Karnes County should have, at a minimum, the primary dispatch channels of all adjacent VHF primary users programmed within their radios as these users are the most likely to respond to a mid-sized interoperability event, such as a rural brush fire. Lack of connectivity to 800 MHz creates the potential for ineffective communications should users from within Bexar County respond to Karnes County.

5.9 Kendall County

Kendall County, with an estimated 2009 population of 34,053, is located in the north central portion of the AACOG. The county is 633 square miles, of which 1 square mile is water. The cities of Boerne and Fair Oaks Ranch, census-designated area of Comfort, and Berghheim, Kenalia, Sisterdale and Waring comprise the county.

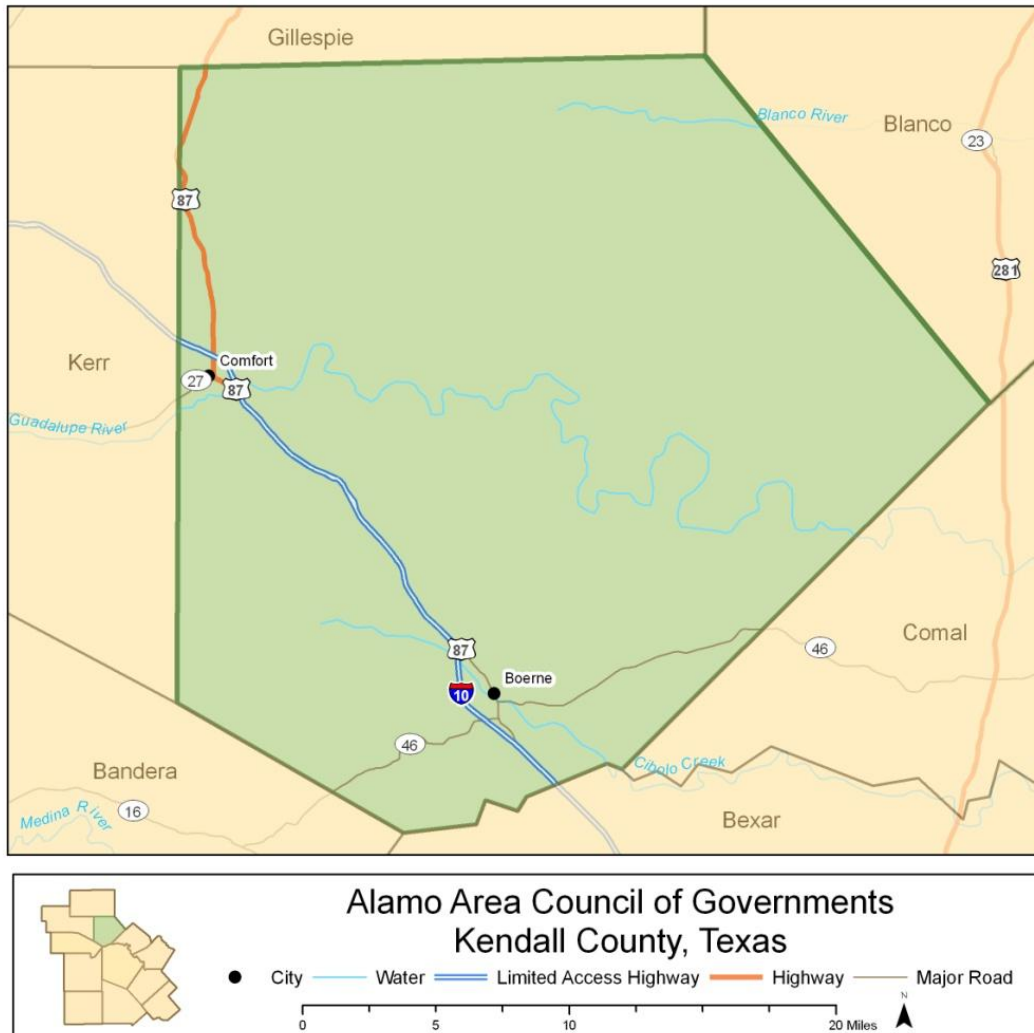


Figure 69 – Kendall County

Through the assessment process, L.R. Kimball found that Kendall County operates two primary radio systems; a one site VHF conventional system for the county VFDs and the LCRA 900 MHz EDACS system utilized by county law enforcement agencies.

5.9.1 Radio System—Kendall County Fire

The Kendall County Fire system is a single site VHF conventional analog system using one primary frequency for fire/EMS dispatch. There are seven VFDs on the system. Four VFDs utilize alternating current (AC) powered mobile radios as base stations for tactical simplex operations. The primary dispatch channel is patched to a talk group on the LCRA system for communications with county law enforcement.

The system currently operates in the wideband analog mode. Subscriber radios in use today are from a mix of manufacturers. Many of the existing subscriber radios are not narrowband capable and must be replaced before 2013.

Interoperability is achieved utilizing shared VHF frequencies. The wideband VHF interoperability channels are programmed into Kendall County radios. Kendall County fire operations have a frequent communication requirement with the Kendall County Road and Bridge department.

5.9.1.1 User Agencies

The following agencies/entities utilize the Kendall County Fire radio system:

Table 163 – Kendall County Fire User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Alamo Springs FD	Fire	Gary Miller	830-990-1460	gralin@ctesc.net
Bergheim FD	Fire	Jeff Hoffstadt	956-642-6025	jhoffstadt@epco.com
Boerne FD	Fire	Doug Meckel	830-249-3644	dmeckel@ci.boerne.tx.us
Comfort FD	Fire	Adam Eihholt		cvfd@hctc.net
Kendalia FD	Fire	David Moore	210-842-2304	dgmoore@gvfc.com
Sisterdale FD	Fire	Larry Langbein	830-285-1949	svfd@hctc.net
Waring FD	Fire	Ralph Treiber	210-422-2160	warinvfd@hctc.net

Agencies on this system are VFDs with varying areas of responsibility, which are predefined and coincide with boundaries of Emergency Services Districts or other political subdivisions.

5.9.1.2 Dispatch Facilities

Dispatch services are provided for the county at the Boerne PD. (Reference the Kendall County law enforcement section for additional information.)

5.9.1.3 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

Capacity—Capacity was indicated to be a major problem for the Kendall County fire services. Currently, the county utilizes a single dispatch channel, with simplex channels utilized for fire ground operations. Capacity problems were indicated to occur during peak times on a regular basis. It is estimated that an additional five to seven channels are need to provide adequate capacity.

Coverage—The current single-site system provides approximately 95 percent mobile coverage and 80 percent portable coverage. Additional radio sites are necessary to meet the coverage needs of the users. The County indicated a desire to utilize a trunking system with multiple sites to address coverage problems.

Funding—Users indicated that funding was a major limitation regarding the choice and availability of radio solutions.

Technology—The County indicated the desire to implement a Kenwood NEXEDGE solution providing 6.25 kHz channel efficiency and data capabilities. A grant funding request was previously denied because the system is not P25 compliant. The County indicated the desire to implement their technology of choice and not be restricted to P25. The County has since rescinded the NEXEDGE request and is not considering migration to the 700 MHz P25 regional system along with Boerne and Kendall County law enforcement.

5.9.1.4 Radio Sites

Kendall County did not provide radio site information. Kendall County Fire provided the following radio shelter information:

Table 164 – Kendall County Fire Radio Shelter

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
EMS Tower	12 x 20	Concrete	2006	Y	Y

5.9.1.5 Radio Inventory

Kendall County Fire provided the following radio equipment information:

Table 165 – Kendall County Fire Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
All seven FDs have a variety of radios from Motorola, Kenwood, Icom and others; EMS is predominantly Kenwood			All	EMS-4 Mobile 8 portable FDs - 55 - 60 Mobile 100+ portable 4 or 5 base stations

Total Mobiles	
Total Portables	
Total Control Stations	
Total	200 (estimate)

5.9.1.6 FCC Licenses

Table 166 – Kendall County Fire FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WPIN418	1	29-51-14.8	98-48-09.1	155.4000	FB2	82	100	200	20K0F3E
	2			150.7900	FX1		30		20K0F3E
	3	40 km radius around location 1		155.4000	FB2		100	200	20K0F3E
				155.4000	MO		100		20K0F3E
WPYS616	1	29-51-14.7	98-48-09.1	159.0450	FB2	80	100	80	20K0F3E, 11K2F3E
	2	32 km radius around location 1		154.8450		MO	45	45	20K0F3E, 11K2F3E
				159.045		MO	45	45	11K2F3E
	3			159.045	FX1		15	25	20K0F3E, 11K2F3E
WPZP989	1	29-47-13.8	98-44-16.1	154.1600	FB	18	45	85	20K0F3E
	2	32 km radius around location 1		154.1600	MO		5	5	20K0F3E
				154.1600	MO		100	100	20K0F3E
WPZY628	1	29-51-14.7	98-48-09.1	155.1900	FB2	82	100	175	20K0F3E
	2	40 km radius around location 1		155.1900	MO		100	100	20K0F3E
				158.9550	MO		100	100	20K0F3E
	3			158.9550	FX1		40	80	20K0F3E
WNUR558	1	29-47-13.8	98-44-16.1	153.2750	FB	18	40	85	20K0F3E, 11K0F3E,

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
									16K0F3E, 20K0F1E, 8K10F1D, 8K10F1E
				153.4400	FB2	18	100	144	11K0F3E, 16K0F3E, 20K0F1E, 8K10F1D, 8K10F1E
	2	40 km radius around location 1		152.3750	MO		40	40	20K0F3E, 11K0F3E, 16K0F3E, 20K0F1E, 8K10F1D, 8K10F1E
				153.4400	MO		40	75	11K0F3E, 16K0F3E, 20K0F1E, 8K10F1D, 8K10F1E
				158.3100	MO		40	75	11K0F3E, 16K0F3E, 20K0F1E, 8K10F1D, 8K10F1E
				158.3250	MO		40	75	11K0F3E, 16K0F3E, 20K0F1E, 8K10F1D, 8K10F1E
	3			158.3250	FX1		45	60	11K0F3E, 16K0F3E, 20K0F1E, 8K10F1D, 8K10F1E
WNDU935	1	29-58-16.8	98-54-35.1	154.1300	FB	23	60	60	20K0F3E
				154.1450	FB		100	100	20K0F3E
	2	32 km radius around location 1		154.1300	MO		60		20K0F3E
				154.14500	MO		100		20K0F3E
WNVL428	1	29-57-52.8	98-30-44.1	154.5400	FB	12	50	95	20K0F3E

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
	2	121 km radius around location 1		154.5400	MO		50		20K0F3E
WPWU448	1	29-59-55.0	98-44-02.0	155.3550	FB2	24	45	50	20K0F3E
	2	40 km radius around location 1		153.860	MO		45	45	20K0F3E
				155.3550	MO		45	45	20K0F3E
	3			153.8600	FX1		45	45	20K0F3E
WPZR911	1	29-56-47.8	98-50-13.1	154.5150	FB	12	50	100	20K0F3E
	2	40 km radius around location 1		154.5150	MO		50	100	20K0F3E

WPIN418—Call sign WPIN418 is issued to Kendall County and covers the repeater pair 155.400 MHz (TX) and 150.790 MHz (RX) and is used for primary EMS dispatch. There is a single repeater site located on the Daggett Ranch off Jennifer Road about one mile west of I-10 and north of Upper Cibolo Creek Road in the Boerne area. This license covers wideband emissions only and will need to be updated to reflect narrowband operation once all relevant equipment has been narrowbanded.

WPYS616—Call sign WPYS616 is issued to Kendall County and covers the repeater pair 159.045 MHz (TX) and 154.845 MHz (RX) and is used for primary fire dispatch. There is a single repeater site located on the Daggett Ranch off Jennifer Road about one mile west of I-10 and north of Upper Cibolo Creek Road in the Boerne area. This license covers wideband emissions only and will need to be updated to reflect narrowband operation once all relevant equipment has been narrowbanded.

WPZP989—Call sign WPZP989 is issued to Kendall County and covers base and mobile operation on a single VHF frequency, 154.160 MHz. This channel is used for fire and tactical operations. There is a single site for this license, located at W. Hosack and S. School St. in Boerne. This license covers wideband operations only and will need to be updated to reflect narrowband operation once all relevant equipment has been narrowbanded.

WPZY628—Call sign WPZY628 is issued to Kendall County and covers the repeater pair 155.1900 MHz (TX) and 152.8300 MHz (RX) and is used for emergency management purposes. There is a single repeater site located on the Daggett Ranch off Jennifer Road. This license covers wideband emissions only, and will need to be updated to reflect narrowband operation once all relevant equipment has been narrowbanded.

WNUR558—Call sign WNUR558 is issued to the Boerne VFD and covers the repeater pair 153.440 MHz (TX) and 158.325 MHz (RX). Also covered under this license are base and mobile operation on 152.375 MHz and 158.310 MHz. This license is used for fire operations by Boerne VFD. There is a single repeater site located on the Daggett Ranch off Jennifer Road. This license covers both wideband and narrowband operation.

WNDU935—Call sign WNDU935 is issued to the Comfort VFD and covers base and mobile operations on 154.130 MHz and 154.145 MHz. These channels are used for FD tactical operations. The transmitter site is located in the 600 block of Fifth Street in Comfort. This license covers wideband emissions only and will need to be updated to reflect narrowband operation once all relevant equipment has been narrowbanded.

WNVL428—Call sign WNVL428 is issued to the Kendalia VFD and covers base and mobile operation on 154.540 MHz. This frequency is used for tactical operations by Kendalia VFD. The single transmitter site is located on an unnamed road south of RM-473 east of Eagle Falls Road in Kendalia. This license covers wideband emissions only and will need to be updated to reflect narrowband operation once all relevant equipment has been narrowbanded.

WPWU448—Call sign WPWU448 is issued to the Sisterdale VFD and covers the repeater pair 155.355 MHz (TX) and 153.860 MHz (RX). This channel is used for tactical operations by the Sisterdale VFD. The transmitter for this repeater is located at 1207 Sisterdale Road, Sisterdale. This license covers wideband emissions only and will need to be updated to reflect narrowband operation once all relevant equipment has been narrowbanded.

WPZR911—Call sign WPZR911 is issued to the Waring VFD and covers base and mobile operations on 154.515 MHz. This channel is used for tactical operations by the Waring VFD. The single transmitter for this frequency is located near the intersection of Kendal Jackson and Napa Ridge in Comfort. This license covers wideband emissions only and will need to be updated to reflect narrowband operation once all relevant equipment has been narrowbanded.

5.9.1.7 System Coverage

User reported coverage is as follows:

Table 167 – Kendall County Fire User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	95%
Portable coverage	80%
In-building coverage	80%

The following coverage map depicts the predicted “talk out” portable coverage for the Kendall County fire/EMS channels. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

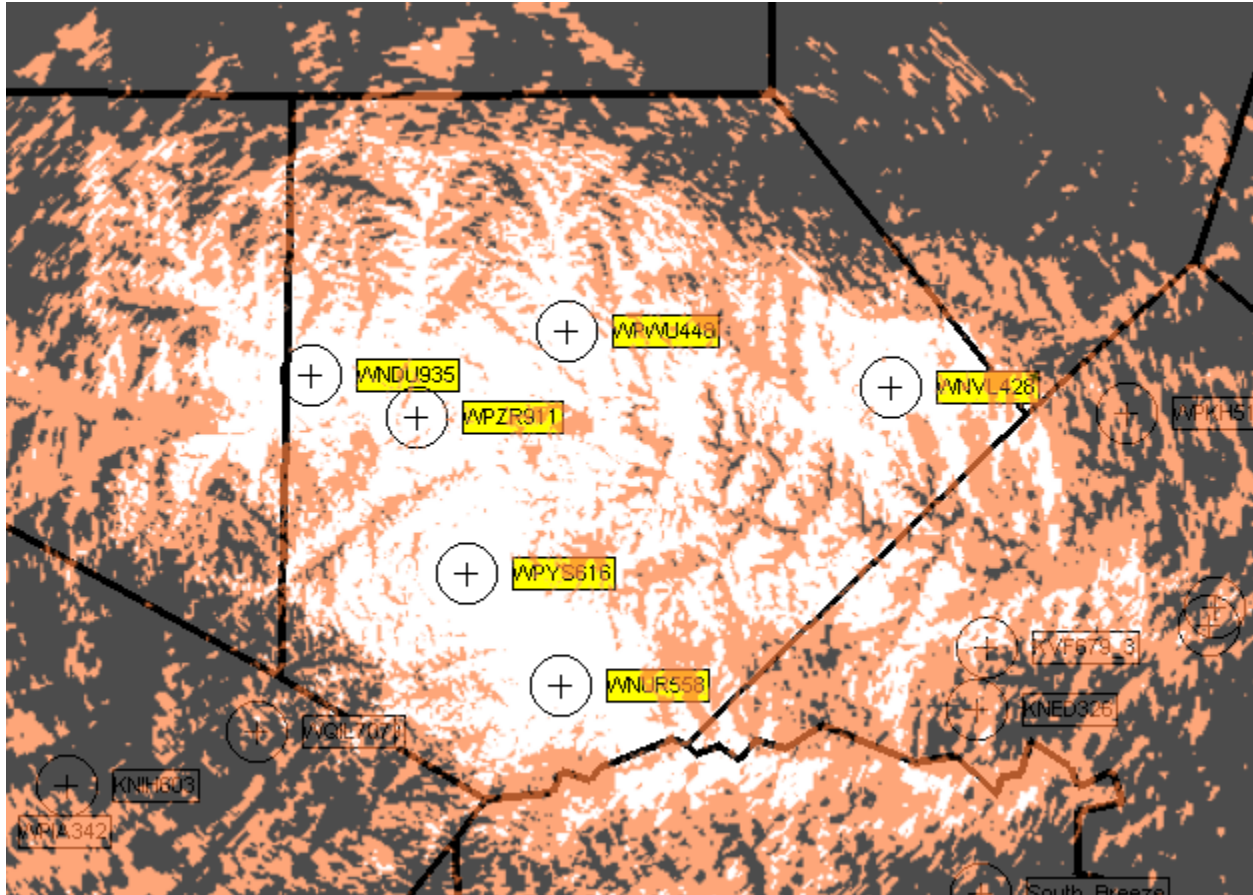


Figure 70 – Predicted Radio Coverage for Kendall County Fire

5.9.1.8 Future Plans

Kendall County plans to install a new system by 2012 to meet narrowbanding requirements. Initially, Kendall County indicated the desire to build out a Kenwood NEXEDGE system. The County is now considering migration to the 700 MHz P25 regional system.

5.9.1.9 Past Expenditures

Kendall County provided the following past radio expenditures:

Table 168 – Kendall County Fire Past Radio Expenditures

Year	Project Description	Total Cost	Funding Source
2007	Replace shelter, generator and UPS at Tower	\$23,352.00	2005 left over HLS grant money

Year	Project Description	Total Cost	Funding Source
2009	Trunking System (not installed yet) Funds have yet to be spent.	\$258,932.00	HLS Grant
2010	Additional funds for trunking system	\$299,000.00	HLS Grant
Total		\$23,352.00 *	

* Funding for the trunking system has not been included in the total for purposes of quantifying additional funds necessary to migrate to the 700 MHz regional system. The unspent funds and funding gaps have been identified in the migration plan section.

5.9.1.10 Future Funding

Kendall County Fire did not identify future funding opportunities beyond the already approved HLS 2009 and 2010 funding.

5.9.1.11 Assessment

Capacity—Capacity on a radio system to accommodate multiple incidents is a must. Utilizing a single radio channel for all public safety disciplines creates the potential for ineffective communications when multiple events occur. In addition, a single channel is virtually impossible to manage during a large-scale interoperability event. There are approximately 210 subscriber radios utilized by the seven VFDs. One channel is insufficient to manage this traffic, especially when multiple incidents occur simultaneously. Multi-discipline incidents will also stretch capacity on the system.

Coverage—Coverage is the most essential feature of any radio system. User feedback indicated that the present radio system provides approximately 80 percent outdoor portable coverage and 95 percent mobile coverage. While this level of coverage may be adequate for some rural agencies, typical coverage requirements for a countywide system are above 95 percent portable coverage. A first responder is at a great risk at all times when responding to incidents outside of radio coverage. For fire/EMS, indoor coverage is especially critical. While simplex frequencies can be used to coordinate an event on-scene while outside of the system coverage area, radio coverage is necessary for calls for backup and to coordinate with other users.

Interoperability—Interoperability today is achieved through the use of shared VHF channels. Primary dispatch frequencies for the surrounding VHF jurisdictions are programmed into fire/EMS radios. When an interoperability response is made, the responding user will switch to the frequency of the agency being assisted. This method of interoperability is effective when capacity on the systems is not an issue and the users are on the same frequency band. In the event of a major multi-jurisdictional disaster, it is likely that these conditions will not hold true. The primary interoperability requirement for Kendall County Fire is with law enforcement users on the LCRA system. Interoperability is achieved through the use of patches to LCRA talk groups. Should a large-scale interoperability event occur, fire users will be limited to the number of VHF channels on the dispatch console that can be patched to LCRA talk groups.

5.9.2 Radio System—Kendall County Law Enforcement

All law enforcement agencies in Kendall County operate on the LCRA 900 MHz EDACS radio system. The primary repeater site used for Kendall County is located at TX-46 and Old Curry Creek Road in Boerne.

5.9.2.1 User Agencies

The following agencies/entities utilize the Kendall Law Enforcement radio system:

Table 169 – Kendall County Law Enforcement User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact Name		
		Name	Phone Number	E-mail
City of Boerne	Law Enforcement	David Flores	830-249-8645	
City of Boerne	Fire	Doug Meckel	830-249-9511	dmecke@tci.boerne.tx.us
City of Boerne	Utility	Mike Mann	830-249-9511	mmann@ci.boerne.tx.us
Kendall County	Law Enforcement	Roger Duncan	830-249-9721	
Kendall County	Fire	Jeff Fincke	830-249-3721	
Kendall County	Utility			
City of Fair Oaks Ranch	Law Enforcement	Scott Rubin	210-698-0988	
City of Fair Oaks Ranch	Utility	Scott Rubin		
DPS	Law Enforcement	DPS Austin		
TX Game Warden	Law Enforcement	Tx Parks & Wildlife Austin		

Table 170 – Kendall County Law Enforcement LCRA Talk Groups

LCRA Talk Group Name	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Boerne/Kendall County All Call	Law Dispatch
Ken SO Disp	Boerne/Kendall County SO Primary
Ken SO TAC1	Boerne/Kendall County TAC-1
Ken SO TAC2	Boerne/Kendall County TAC-2
Boerne TA 1	Boerne/Kendall County BOERNE-1
Boerne TA 2	Boerne/Kendall County BOERNE-2
Ken SO TA 1	Boerne/Kendall County KENDALL-1
Ken SO TA 2	Boerne/Kendall County KENDALL-2
Ken SO Ops 1	Kendall County SO OPS-1

5.9.2.2 Dispatch Facilities

All public safety dispatching in Kendall County is performed at the Boerne PD. The communications center is located at the Boerne PD, 124 Old San Antonio Rd., in Boerne. There is no secondary dispatch center in the county.

Channels appearing on the console include:

Table 171 – Kendall County Law Enforcement Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Primary	Law Enforcement
TAC1	Law Enforcement
TAC2	Law Enforcement
Common	City of Boerne Utility
Spare	All Call (L.E., COB Utility, SO VHF)
SO VHF	Kendall SO
Fire 1	Kendall FD – Primary
Fire 2	Kendall FD – Secondary
EMS	Kendall Co EMS
I/C Car	Intercity

5.9.2.3 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

Interoperability—Interoperability is limited with users in Bexar County, Comal County, Blanco County, and Bandera County. Interoperability gaps are the result of disparate frequency bands with insufficient gateways to interconnect the systems.

System Migration—The LCRA system is migrating to OpenSky; law enforcement within Kendall County will either need to migrate to the 900 MHz OpenSky system, migrate to the pending 700 MHz LCRA overlay, or build out new system architecture.

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5.9.2.4 Radio Sites

Kendall County Law Enforcement provided the following radio site information:

Table 172 – Kendall County Law Enforcement Radio Site

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Boerne	6.5 miles NW, Boerne, TX	LCRA	Unknown	Unknown
Highway 46E	828 South Highway 46E, Boerne, TX	LCRA	Unknown	Unknown
Lukenbach	6 Miles SW, Lukenbach, TX	LCRA	Unknown	Unknown

Kendall County Law Enforcement provided the following radio shelter information:

Table 173 – Kendall County Law Enforcement Radio Shelter

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
Boerne	Not Provided	Concrete	Not Provided	Y	Y
Highway 46E	Not Provided	Concrete	Not Provided	Y	Y
Lukenbach	Not Provided	Concrete	Not Provided	Y	Y

5.9.2.5 Radio Inventory

Kendall County Law Enforcement provided the following radio equipment information:

Table 174 – Kendall County Law Enforcement Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Boerne (LE)	M/A Harris	LPE Orion	Portable	33
	M/A Harris	5300	Mobile	22
	M/A Harris	5300	Control Station	7
Boerne (Fire)	M/A Harris	5300	Mobile	1
Boerne (Utility)	M/A Harris	5300	Control Station	1
	M/A Harris	5300	Portable	44
	M/A Harris	5300	Mobile	0
Fair Oaks Ranch	M/A Harris	LPE Orion	Portable	12
	M/A Harris	5300	Mobile	15

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
	M/A Harris	5300	Control Station	2
Fair Oaks Ranch Utility	M/A Harris	LPE Orion	Portable	5
	M/A Harris	5300	Mobile	5
Kendall County SO	M/A Harris	LPE Orion	Portable	65
	M/A Harris	5300	Mobile	60
Kendall County SO (VHF)	Not Provided	Not Provided	Mobile	49
DPS	M/A Harris	5300	Mobile	2
	M/A Harris	LPE Orion	Portable	2
Tx Parks / Wildlife	M/A Harris	5300	Mobile	1
Total Portables				161
Total Mobiles				155
Total Control Stations				10
Total				326
900 MHz Subscribers – Total				277

5.9.2.6 FCC Licenses

Table 175 – Kendall County Law Enforcement FCC License

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WPLZ918	2	29-50-27.8	98-49-34.1	See FCC license	FB2	158	100	500	11K0F1D 11K0F2D 11K0F3E
WPYF305	5	29-49-20.7	98-34-55	See FCC license	FB2	75.9	100	500	11K0F1D 11K0F2D 11K0F3E
WPLZ920	3	30-8-3	98-40-21	See FCC License	FB2	138	100	500	11K0F1D 11K0F2D 11K0F3E

WPLZ918, WPYF305, WPLZ920—Call signs WPLZ918, WPYF305, and WPLZ920 cover the operation of radio sites that provide service to the Kendall County area. Each call sign covers one of the three radio sites in Kendall County as well as other radio sites in the LCRA network. The licenses do not reflect mobile and control station operation.

5.9.2.7 System Coverage

User reported coverage is as follows:

Table 176 – Kendall County Law Enforcement User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	95%
Portable coverage	80%
In-building coverage	80%

The following coverage map depicts the predicted “talk out” portable coverage for the LCRA radio system in Kendall County. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

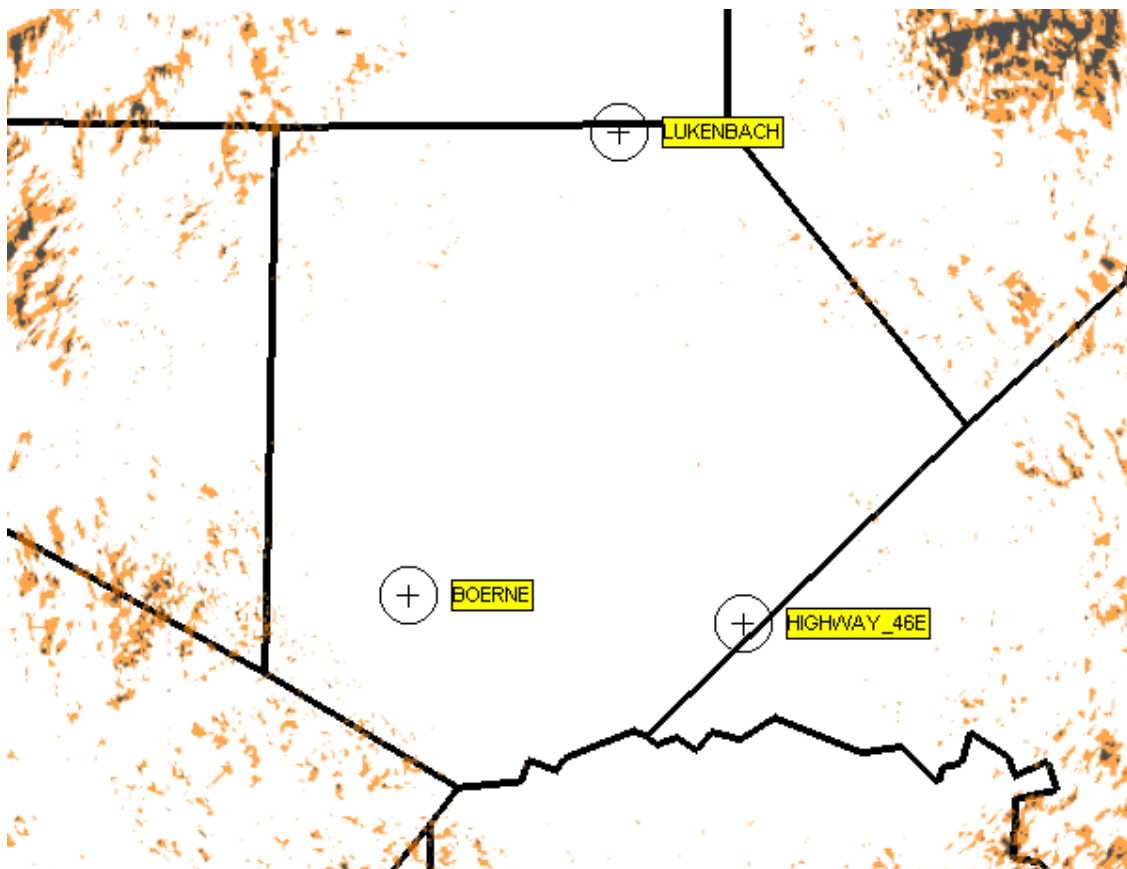


Figure 71 – Predicted Radio Coverage for Kendall County on LCRA System

Propagation analysis indicates excellent portable coverage on the LCRA system within Kendall County. No significant dead spots or marginal areas within the county borders are predicted.

5.9.2.8 Assessment

System Migration—The pending LCRA system migration places Kendall County in a position to migrate systems as well. Most subscriber units on the LCRA system are P5300 and M5300 models. These radios will support OpenSky operation, but may require software upgrades to operate in the OpenSky modes. Orion radios currently utilized within Kendall County will not support OpenSky operation and must be replaced. Alternatively, migration to the P25 LCRA overlay will require replacement of all Kendall County subscriber radios.

Interoperability—Interoperability for Kendall County users on the LCRA system is limited with several agencies, including Bexar County, Comal County, Blanco County, and Bandera County. Interoperability is limited because of the disparate frequency bands used by LCRA and other public safety agencies in the VHF and 800 MHz bands. Interoperability is achieved through the use of gateways to interconnect the systems. The interoperability gaps identified are the result of insufficient gateways to interconnect the systems.

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5.10 Kerr County

Kerr County, with an estimated 2009 population of 48,381, is located in the northern portion of the AACOG. The county is 1,108 square miles, of which 2 square miles is water. The cities of Ingram and Kerrville and unincorporated areas of Center Point, Hunt and Mountain Home comprise the county.

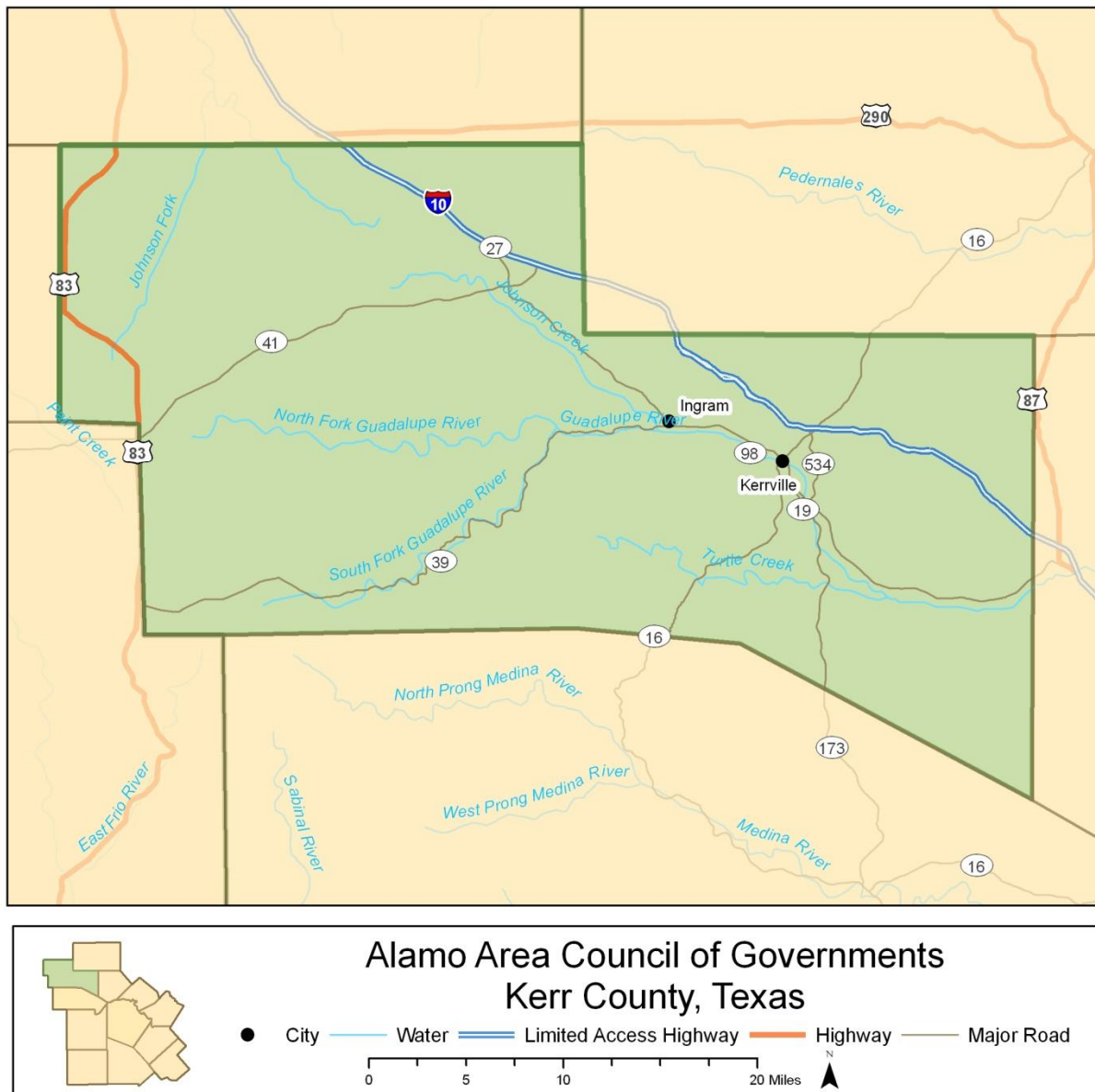


Figure 72 – Kerr County

There are five primary radio systems within Kerr County: a VHF conventional system used by the Kerrville FD, a VHF conventional system used by the Kerrville PD, a VHF simulcast system used by the Kerr County SO, a VHF conventional system used by the county VFDs, and a VHF conventional system utilized by the Ingram PD.

5.10.1 Radio System—Kerrville Fire Department

The Kerrville FD operates a three-site VHF conventional radio system. The system utilizes a single repeater at each radio site, and is capable of operation in P25 and analog modes. A UHF repeater is maintained for EMS operations. Radio equipment is primarily Motorola. Motorola's proprietary ADP encryption is utilized. The system was installed in July of 2010. Dispatch for the system is managed by the Kerrville PD dispatch center.

5.10.1.1 User Agencies

The following agencies/entities utilize the Kerrville FD radio system:

Table 177 – Kerrville FD User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Kerr FD/EMS	Fire/EMS	Mark Beavers	830-257-8449	Mark.Beavers@kerrvilletx.gov
Kerr PD	Law Enforcement	Jeff Wendling	830-257-8181	Jeffrey.Wendling@kerrvilletx.gov
Kerr County SO	Law Enforcement	Clay Barton	830-896-1216	cbarton@co.kerr.tx.us
Ingram Marshal	Law Enforcement	Rowan Zachry	830-367-2636	Not Specified
Center Point VFD	Fire	Danny Smith	830-634-2323	Not Specified
Junction VFD	Fire	Lee Hall	325-446-8552	Not Specified
Comfort VFD	Fire	Daniel Morales	830-995-2124	Not Specified
Mountain Home VFD	Fire	Hank Poorman	830-866-3310	Not Specified
Elm Pass VFD	Fire		830-634-2083	Not Specified
Tierra Linda VFD	Fire	Mike Lannan	830-792-3533	Not Specified
Hunt VFD	Fire	Danny Feller	830-238-4371	Not Specified
Turtle Creek VFD	Fire	Mike Heath	830-257-3550	Not Specified
Ingram VFD	Fire	Ray Lynch	830-367-5641	Not Specified

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5.10.1.2 Dispatch Facilities

Dispatch services for the fire system are provided by the Kerrville PD PSAP located at 429 Sidney Baker, Kerrville. Three Zetron 4000 series consoles are utilized as the primary dispatch device. Channels appearing on the console include:

Table 178 –Kerrville FD Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
KKFD/EMS	FD/EMS
KFD EAST	FD/EMS
KFD WEST	FD/EMS
KFD #2	FD/EMS
EMS – UHF	EMS

No secondary PSAP services are available.

5.10.1.3 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

Coverage—Coverage problems were indicated on the radio system; however, these problems were not reported to be serious in nature. Portable and in-building coverage is estimated at 80 percent throughout the primary jurisdiction. User feedback indicates that one additional radio site should be sufficient to meet coverage needs.

Interoperability—Interoperability gaps were identified with Kerrville Independent School Districts, Kerrville Public Works, Bandera Electric, and Central Texas Electric Cooperation. The agencies were listed as potential mutual aid partners in the event of a major disaster.

5.10.1.4 Radio Sites

Kerrville FD provided the following radio site information:

Table 179 – Kerrville FD Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Smokey Mt Kerrville, Texas 78028	End of 5 th St 78028	Advantage Inc.	14 Years	Y
West	11 miles west of Mt. Home on Hwy 41	Central Texas Electric	30 Years	Y
East	2 miles west of Comfort on Hwy 27	Hermann Sons Camp	30 Years	N
Cherry Ridge	2.5 miles north of IH10 on Hwy 16	Advantage	10 Years	Y

Kerrville FD provided the following radio shelter information.

Table 180 – Kerrville FD Radio Shelters

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
Smokey Mt	10'x10'	Concrete block	1995	Y	Y
West	12'x20'	Concrete block	1980	N	Y
East	Outdoor weatherproof cabinet 5'x2'x2'	Steel	2006	N	N
Cherry Ridge	12'x20'	Steel	2000	Y	Y

5.10.1.5 Radio Inventory

Kerrville FD provided the following radio equipment information.

Table 181 – Kerrville FD Fixed Radio Information

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
Smokey Mt	2 repeater	Motorola	Quantar	VHF
	Base station	Motorola	Quantar	VHF
	Combiners	Motorola	Quantar	VHF
	Multi-coupler	Motorola	Quantar	VHF
West	Duplex	Motorola	Quantar	VHF
East	Duplex	Motorola	Quantar	VHF
Cherry Ridge	Repeater	Motorola	R1225	UHF

Table 182 – Kerrville FD Subscriber Radio Information

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Kerrville FD	Motorola	XTL 1500	Mobile	22
	Motorola	XTS 2500	Portable	51
	Motorola	XTL 2500	Control Station	2
	Motorola	XTL1500	Control Station	10
	Motorola	XTL 2500	Mobile	1
	Motorola	CM 300	Control Station	1
Total Portables				51

Total Mobiles	23
Total Control Stations	13
Total	87

5.10.1.6 FCC Licenses

Table 183 – Kerrville FD FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WPGV728	1	30-6-7.8	99-4-39.1	462.9500	FB2	67	100	148	11K3F1D 11K3F3E 20K0F2E
	2	30-2-37.7	99-7-17.1	154.2350 154.3550	FB FB2	43 67	100 100	200 100	11K3F1D 11K3F3E 20K0F2E
	3	32 km around 30-6-6.8 N 99-4-41.1 W		462.9500 467.9500	MO		50	50	11K3F1D 11K3F3E 20K0F2E
	4	40 km around location 2		154.2350 154.2800 154.3550 158.8050	MO		40	40	11K3F1D 11K3F3E 20K0F2E
	5	30-8-39.7	99-32-41.2	155.8350 154.3550	FB2	121.9	90	90	11K3F1D 11K3F3E 20K0F2E
	6	29-56-27	98-55-43.2	154.8750 154.3550	FB2	30.8	90	120	11K3F1D 11K3F3E 20K0F2E
WQLG572	1	30-2-37.7	99-7-17.1	158.8425	FB2	61	90	160	11K3F1D 11K3F3E
	2	Kerr County		158.8425 153.8075	MO		50	50	11K3F1D 11K3F3E

WPGV728—Call sign WPGV728 is licensed by the city of Kerrville and covers the operation of the three primary radio sites utilized by the Kerrville FD and the UHF repeater at Cherry Point. The main frequency 154.3550 is licensed at all three locations in a simulcast configuration; however, it is currently used as a repeater at the primary Smokey Mt site. The license will cover future plans to simulcast the channel at all three locations. Emissions on the license reflect wideband and narrowband analog operation, but do not reflect the P25 emissions 8K10F1D and 8K10F1E. These emissions should be added to reflect P25 operation

WQLG572—Call sign WQLG572 is licensed by the city of Kerrville and covers the operation of a repeater frequency at the Smoke Mt location. The repeater frequency is referred to as KFD 2 on the dispatch console, and is used as a secondary channel by the Kerrville FD. Emissions on the license reflect narrowband analog operation, but do not reflect the P25 emissions 8K10F1D and 8K10F1E. These emissions should be added to reflect P25 operation. The stations have an upcoming construction deadline of January 14, 2011.

5.10.1.7 System Coverage

L.R. Kimball notes that the Kerrville FD radio system has indicated radio coverage issues. User reported coverage is as follows:

Table 184 – Kerrville FD User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	95%
Portable coverage	80%
In-building coverage	80%

The following coverage map depicts the predicted “talk out” portable coverage for the Kerrville FD radio system. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

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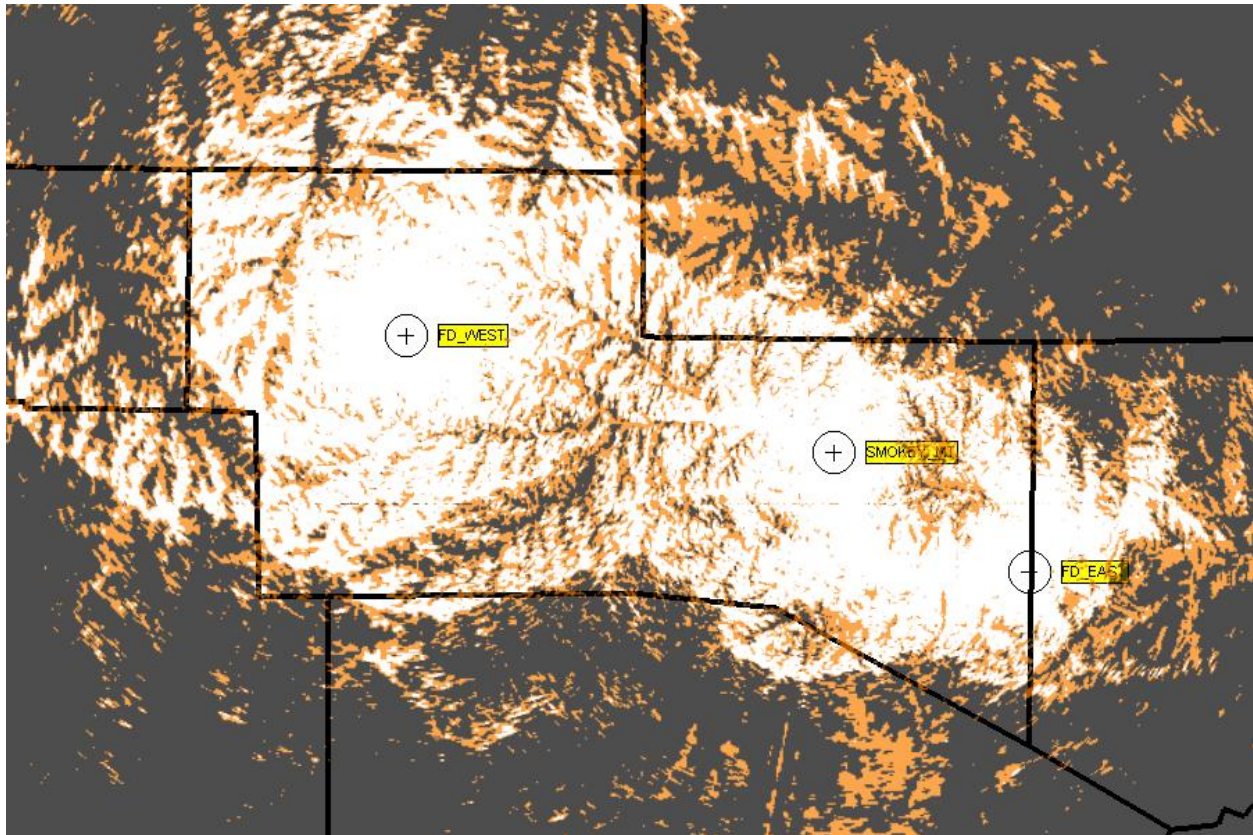


Figure 73 – Predicted Radio Coverage for Kerrville FD

The Kerrville FD system provides adequate countywide portable coverage. Coverage problems exist along the county borders northeast and southeast of Kerrville and in terrain-challenged areas in the center of the county along the south fork of the Guadalupe River.

5.10.1.8 Future Plans

Kerrville FD indicated the following future plans:

Simulcast—Plans were indicated to upgrade the three primary repeater sites in a simulcast configuration. The estimated cost for this upgrade is \$539,000.

Additional Site—A fourth repeater site is planned to add additional coverage to the fire system. The estimated cost for this upgrade is \$110,000.

Mobile Gateway—Plans are in place to purchase a mobile deployable gateway at an estimated cost of \$6,000.

5.10.1.9 Past Expenditures

Kerrville FD provided the following past radio expenditures:

Table 185 – Kerrville FD Past Radio Expenditures

Year	Project Description	Total Cost	Funding Source
2006	Communications–Fire Operations & Firefighter Safety	\$48,192	AFG
2008	Enhance Interoperable Communications System	\$74,430	SHSP
2009	Enhance Interoperable Communications System	\$131,622	HSGP
Total		\$254,244	

5.10.1.10 Future Funding

Kerrville FD identified the following future funding opportunities:

Table 186 – Kerrville FD Future Funding Sources

Funding Source	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Texas										
PSIC										
IECGP										
AFG / DHS	\$540,000	\$110,000	\$6,000 \$12,000	\$90,000						
Other										
Region										
Total	\$540,000	\$110,000	\$18,000	\$90,000						
Total									\$758,000	

5.10.1.11 Assessment

Split Resources—Presently, there are four distinct radio systems in use within Kerr County: the Kerr County SO system, the County fire system, the Kerrville FD system and the Kerrville PD system. The Kerrville FD system provides countywide coverage; however, the primary jurisdiction for the Kerrville FD is the city of Kerrville. The County fire system also provides countywide coverage. This diversification in resources limits the availability to enhance any one particular system, which could simultaneously solve the needs of all county users. User feedback from VFDs indicated that additional channels were needed to handle multiple fire incidents. With the sites and channels in place, capacity should not be a problem. A considerable amount of funding has been spent within the county to upgrade subscriber equipment and infrastructure to public safety-grade equipment that is both narrowband

and P25 compliant. Additional funding is planned to upgrade the Kerrville FD system to simulcast. Considerable savings could be recognized by combining radio sites that provide equivalent coverage areas, and implementing a common shared conventional simulcast or trunking system. County VFDs are not utilizing fully P25 compliant subscriber fleets, and thus cannot access Kerrville FD repeaters operating in the P25 mode

Interoperability—Interoperability today is achieved through the use of shared VHF channels. Primary dispatch frequencies for the surrounding VHF jurisdictions are programmed into fire/EMS radios. When an interoperability response is made, the responding user will switch to the frequency of whichever agency they are assisting. This method of interoperability is effective when capacity on the systems is not an issue and the users are on the same frequency band. Public safety users within Kerr County are primarily in the VHF band and are able to communicate directly through the use of shared channels. However, other county users, including the utility departments and school districts, have no direct communications capabilities with first responders. A 900 MHz control station located at the SO PSAP provides connectivity to the LCRA EDACS system. No connectivity is currently in place in the 800 MHz band.

Conventional Architecture—The present Kerrville FD radio system utilizes a conventional architecture, requiring radio users to switch channels to access different repeater sites. The plans in place to simulcast the three repeaters will solve this problem, permitting seamless roaming from site to site. A trunking system will also provide site to site roaming capabilities.

5.10.2 Radio System—Kerrville Police Department

The Kerrville PD operates a two-site VHF P25 conventional radio system with repeater channels. Two repeaters are at the Smokey Mountain radio site and one repeater is at the Cherry Ridge repeater site. The system utilizes Motorola equipment with Motorola proprietary ADP encryption. The three channels (referred to as KPD 1, KPD 2, and KPD 3) are used for primary dispatch, secondary tactical and special crimes, respectively.

5.10.2.1 User Agencies

The following agencies/entities utilize the Kerrville PD radio system:

Table 187 – Kerrville PD User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	Email
Kerr FD/EMS	Fire/EMS	Mark Beavers	830-257-8449	Mark.Beavers@kerrvilletx.gov
Kerr PD	Law Enforcement	Bill Price	830-257-8181	Bill.price@kerrvilletx.gov
Kerr County SO	Law Enforcement	Clay Barton	830-896-1216	cbarton@co.kerr.tx.us
Ingram Marshal	Law Enforcement	Rowan Zachry	830-367-2636	Not Specified

5.10.2.2 Dispatch Facilities

Zetron 4000 consoles are utilized as the primary dispatch device. Channels appearing on the console include:

Table 188 – Kerrville PD Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
KPD 1	KPD Primary Dispatch
KPD 2	Secondary KPD Channel
KPD 3	Special Crimes Usage

5.10.2.3 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

Coverage—Coverage was reported as adequate throughout the Kerrville jurisdiction, however the need was expressed for an additional tower on the west side of the city.

Interoperability—Interoperability gaps were identified with Kerr Road and Bridge, Kerr County VFDs, TXDOT, Kerrville Public Works, Central Texas Electric Cooperation, Kerrville Public Utility Board, and Kerrville Independent School Districts. The agencies were listed as potential mutual aid partners in the event of a major disaster. Interoperability can be achieved through the implementation of control stations at the Kerrville PD.

5.10.2.4 Radio Sites

Kerrville PD provided the following radio site information:

Table 189 – Kerrville PD Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Smokey Mountain	End of 5 th Street, Kerrville, TX	Advantage Inc.	14 Years	Y
Cherry Ridge	2.5 miles North of IH-10 on Highway 16	Advantage Comm	10 Years	Y

The remainder of this page intentionally left blank.

Kerrville PD provided the following radio shelter information:

Table 190 – Kerrville PD Radio Shelters

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
Smokey Mountain	10' X 10'	Concrete	14 Years	Y	Y
Cherry Ridge	12' X 20'	Metal and Wood	10 Years	Y	Y

5.10.2.5 Radio Inventory

Kerrville PD provided the following radio equipment information:

Table 191 – Kerrville PD Radio Equipment

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
Smokey Mt	2 repeaters	Motorola	Quantar	VHF
	1 Receiver / Multi-coupler	DB Products		VHF
	1 TX Combiner	DB Products		VHF
Cherry Ridge	Repeater	Motorola	Quantar	VHF
	Duplexer	Sinclair		VHF

Table 192 – Kerrville PD Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Kerrville PD	Motorola	XTS 2500	Portable	60
	Motorola	XTL 1500	Mobile	40
	Motorola	XTL 2500	Control Station	3
Total Mobiles				40
Total Portables				60
Total Control Stations				3
Total				103

The remainder of this page intentionally left blank.

5.10.2.6 FCC Licenses

Table 193 – Kerrville PD FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
KVF683	1	30-2-37.8	99-7-17.1	45.2400 155.4150	FB FB2	23 49	100 100	75 200	20K0F3E 20K0F1E 11K3F1D 11K3F1E 11K3F3E
	2	30-2-56.8	99-8-19.1	155.1300	FB	15	100	250	20K0F3E 20K0F1E 11K3F1D 11K3F1E 11K3F3E
	3	24 km around location 1		45.2400 154.9500 155.1300 155.4150 156.2100	MO		50		20K0F3E 20K0F1E 11K3F1D 11K3F1E 11K3F3E
WQAV389	1	30-2-37.7	99-7-17.1	154.7325	FB2	75.9	100	200	11K3F1D 11K3F1E 11K3F3E
	2	32 around location 1		156.1575	MO		45	45	11K3F1D 11K3F1E 11K3F3E
WQKA361	1	30-6-7.5	99-4-39.6	154.1075	FB2	68.1	100	180	11K3F1D 11K3F1E 11K3F3E
	2	Kerr County		158.9325 154.1075	MO		45	45	11K3F1D 11K3F1E 11K3F3E
WQKE813	1	30-2-37.7	99-7-17.1	154.0625	FB2	24	25	45	11K3F1E 11K3F3E
	2	30-00-39.1	99-7-13.9	155.2575	FB2	28	45	60	11K3F1E 11K3F3E
	3	30-3-15.7	99-7-45.8	158.7525	FB	10.7	45	60	11K3F1E 11K3F3E
	4	15 km around location 1		154.0625 154.8975 155.2575 158.7525 153.7625	MO		45	40	11K3F1E 11K3F3E

KVF683—Call sign KVF683 is licensed by the city of Kerrville and covers repeater operations at the Smokey Mt site and simplex operations at the Kerrville PD dispatch center. The repeater channel is the KPD 1 primary dispatch channel. The license covers operation of a VHF low band base station at the Smokey Mt site. Emissions on the license reflect wideband and narrowband operation, but do not cover the P25 emissions 8K10F1D and 8K10F1E. The license does not cover control station operation.

WQV389—Call sign WQAV389 is licensed by the city of Kerrville and covers repeater operation at the Smokey Mt site. The repeater channel is the KPD 2 channel used as a secondary police tactical channel. The license does not cover talkaround or control station operation. Emissions on the license reflect wideband and narrowband operation, but do not cover the P25 emissions 8K10F1D and 8K10F1E. The license does not cover control station or talkaround operation.

WQKA361—Call sign WQKA361 is licensed by the city of Kerrville and covers operations at the Cherry Ridge site. The repeater channel is the KPD 3 channel used for special crimes. The license does not cover talkaround or control station operation. Emissions on the license reflect wideband and narrowband operation, but do not cover the P25 emissions 8K10F1D and 8K10F1E. The license does not cover control station operation.

WQKE813—Call sign WQKE813 is licensed by the city of Kerrville and covers repeater operation for the Kerrville Public Works Department.

5.10.2.7 System Coverage

L.R. Kimball notes that the Kerrville PD radio system has radio coverage issues. User reported coverage is as follows:

Table 194 – Kerrville PD User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	99.9%
Portable coverage	95%
In-building coverage	90%

The following coverage map depicts the predicted “talk out” portable coverage for the Kerrville PD radio system. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

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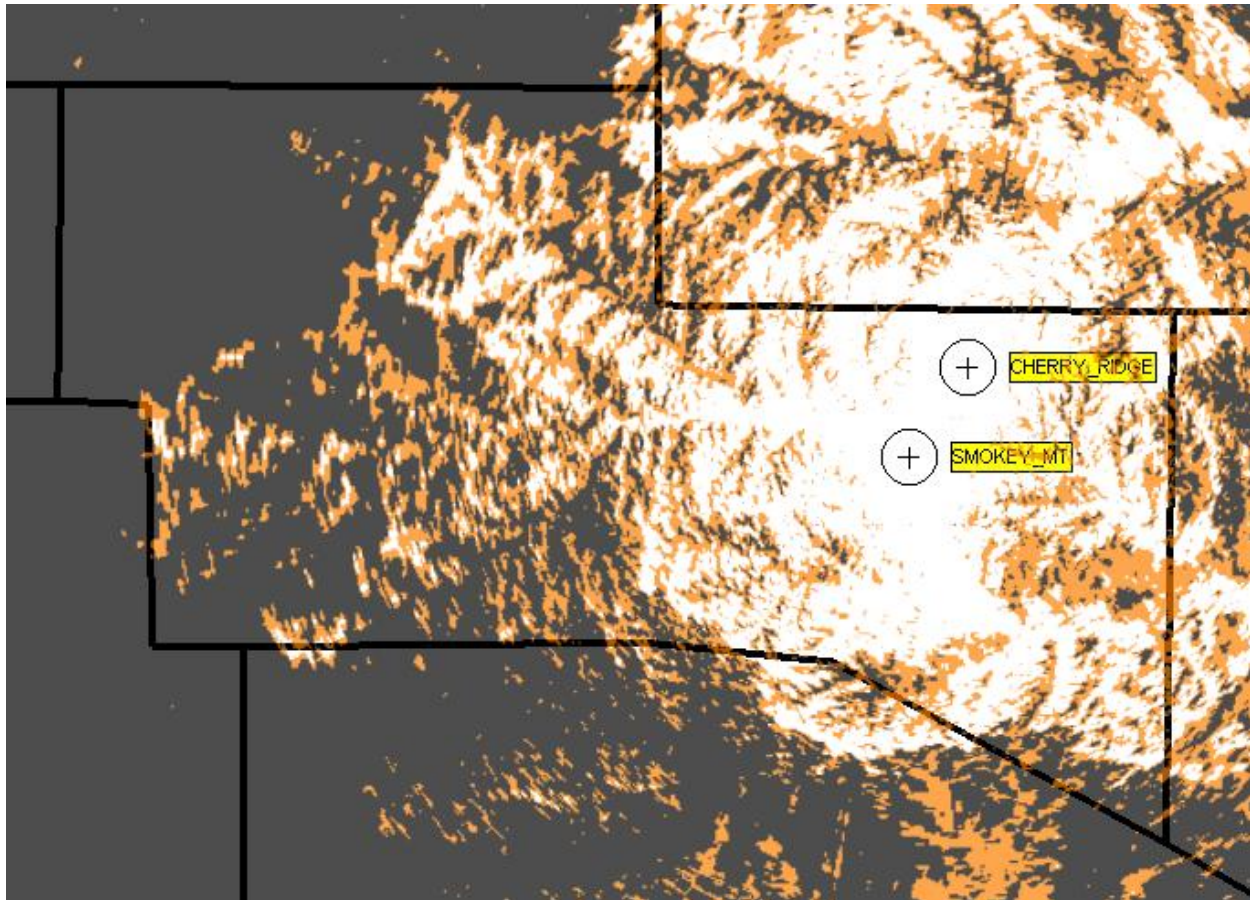


Figure 74 – Predicted Radio Coverage for Kerrville PD

Propagation studies indicate that the Kerrville PD radio system provides adequate portable coverage in the areas surrounding the city of Kerrville.

5.10.2.8 Future Plans

Kerrville PD indicated the following future plans:

New Site—Plans were indicated for an additional radio site on the west side of Kerrville.

5.10.2.9 Past Expenditures

Kerrville PD did not provide past radio expenditures.

5.10.2.10 Future Funding

Kerrville PD did not identify future funding opportunities.

5.10.2.11 Assessment

Interoperability—Interoperability today is achieved through the use of shared VHF channels. Primary dispatch frequencies for the surrounding VHF jurisdictions are programmed into fire/EMS radios. When an interoperability response is made, the responding user will switch to the frequency of whichever agency they are assisting. This method of interoperability is effective when capacity on the systems is not an issue and users are on the same frequency band. Public safety users within Kerr County are primarily in the VHF band, and are able to communicate directly through the use of shared channels. However, other county users including the utility departments and school districts have no direct communications capabilities with first responders. A 900 MHz control station located at the SO PSAP provides connectivity to the LCRA EDACS system. No connectivity is currently in place in the 800 MHz band.

Interoperability is limited between the Kerrville PD and VFDs throughout the county. This level of interoperability can be achieved through the programming of Kerrville VFD FIRE COM channels into Kerrville PD radios. There is a high likelihood that these users will need to communicate directly in the event of a major disaster.

5.10.3 Radio System—Kerr County Sheriff's Office

The Kerr County SO system is a VHF conventional simulcast system that utilizes four radio sites with two repeaters at each radio site. The system operates in the narrowband analog mode. A microwave network provides backhaul between the radio sites. The two channels are used for “primary” and “secondary” operations.

5.10.3.1 User Agencies

The following agencies/entities utilize the Kerr County SO radio system:

Table 195 – Kerr County SO User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	Email
Kerr FD/EMS	Fire/EMS	Mark Beavers	830-257-8449	Mark.Beavers@kerrvilletx.gov
Kerr PD	Law Enforcement	Jeff Wendling	830-257-8181	Jeffrey.Wendling@kerrvilletx.gov
Kerr County SO	Law Enforcement	Clay Barton	830-896-1216	cbarton@co.kerr.tx.us
Ingram Marshal	Law Enforcement	Rowan Zachry	830-367-2636	Not Specified
Kerr County Constables and Deputies	Law Enforcement			
Center Point VFD	Fire	Danny Smith	830-634-2323	Not Specified
Junction VFD	Fire	Lee Hall	325-446-8552	Not Specified
Comfort VFD	Fire	Daniel Morales	830-995-2124	Not Specified
Mountain Home VFD	Fire	Hank Poorman	830-866-3310	Not Specified
Elm Pass VFD	Fire		830-634-2083	Not Specified
Tierra Linda VFD	Fire	Mike Lannan	830-792-3533	Not Specified

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	Email
Hunt VFD	Fire	Danny Feller	830-238-4371	Not Specified
Turtle Creek VFD	Fire	Mike Heath	830-257-3550	Not Specified
Ingram VFD	Fire	Ray Lynch	830-367-5641	Not Specified

5.10.3.2 Dispatch Facilities

Dispatch services for the Kerr County SO system are provided at the Kerr County SO, 400 Clearwater Paseo, in Kerrville. The center has three Zetron 4000 Series consoles that provide access to most radio channels within Kerr County and provide console patching capability for interoperability purposes. TXLAW1 and TXLAW2 are monitored at the center. Control stations with digital remotes provide access to various VHF and 900 MHz systems within and neighboring Kerr County. When accessed, these channels can be patched to the primary SO channels. Channels appearing on the console include:

Table 196 – Kerr County SO Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Kerr Channel 1	Sheriff Primary
Kerr Channel 2	Sheriff Secondary
Kerrville Police Channel 1	LE
Kerrville Fire/EMS	
TXLaw 2	
TXLaw 1	
Ingram City Marshal	
VHF Area 1 – In County	TAC4, Firecom, Task Force, Jail, Ingram, Kerr PD, KFD Rt
VHF Area 2 – In County	TAC4, Firecom, Task Force, Jail, Ingram, Kerr PD, KFD Rt
Out of County	Edwards, Real, Mutual aid, TXDOT, Bandera, Kimble, Gillespie, Kendall
900 MHz	Hill Country Common, Kerr Car-car, Kerrville Pub-Com 1, Kerrville Pub-Com2, Kerrville LCRA Com1, LCRA Com2, LCRA Com3, LCRA Com4, LCRA Com5, Kerrville CC Center, Kerrville LCRA EOC
Kerr Road and Bridge	

5.10.3.3 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

Coverage—Serious coverage problems were reported on the Kerr County system, with mobile estimates at 95 percent, portable estimates at 80 percent, and in-building estimates at 50 percent. User feedback indicated that at least one additional radio site was necessary to meet coverage needs.

Interoperability—Interoperability gaps were identified with TXDOT, school districts, and utility companies. Interoperability gaps are the result of a lack of shared channels and disparate frequency bands. The console provides patching capabilities to interconnect VHF and 900 MHz users, but does not provide 800 MHz connectivity for incoming users from San Antonio who could support a major interoperability event.

Simulcast Overlap—User feedback indicated that radio usage was problematic in the simulcast overlap areas. This is likely the result of conflicting simulcast signals resulting from poorly timed transmissions or distances greater than those recommended for simulcast site separation.

5.10.3.4 Radio Sites

Kerr County SO provided the following radio site information:

Table 197 – Kerr County SO Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
LCRA Legion	Cypress Creek Road 3.5 Miles East of Kerrville	LCRA	Unknown	
Granada	Lot 311 Coultrass Road	LCRA	Unknown	
Elm Pass	Elm Pass Rd 1.59 miles South of Center Point	Mosty	Unknown	
Black Bull	Hwy 41- 10 miles west of Mountain Home	West Central Wireless	Unknown	

Kerr County SO provided the following radio shelter information:

Table 198 – Kerr County SO Radio Shelters

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
LCRA Legion	8' X 10'	Concrete	Unknown	Y	Y
Granada	8' X 10'	Wood	2001	Y	Y
Elm Pass	8' X 10'	Wood	2001	Y	Y
Black Bull	8' X 10'	Wood	2001	Y	Y

5.10.3.5 Radio Inventory

Kerr County SO provided the following radio equipment information:

Table 199 – Kerr County SO Radio Equipment

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
LCRA Legion	2 Repeaters			
	Simulcast Controller			
	Combiner			
	Multi-coupler			
	UPS			
Granada	2 Repeaters			
	Simulcast Controller			
	Combiner			
	Multi-coupler			
	UPS			
Elm Pass	2 Repeaters			
	Simulcast Controller			
	Combiner			
	Multi-coupler			
	UPS			
Black Bull	2 Repeaters			
	Simulcast Controller			
	Combiner			
	Multi-coupler			
	UPS			

Table 200 – Kerr County SO Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Kerr County SO	Motorola	XTS 2500	Portable	56
	Motorola	XTL 1500	Mobile	56
	Motorola	CM-300	Control Station	2
Total Mobiles				56
Total Portables				56
Total Control Stations				2
Total				114

5.10.3.6 FCC Licenses

Table 201 – Kerr County SO FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
KVF682	1	30-00-37	99-15-47	155.3700 155.0850 155.5500	FB FB2 FB2	91 79 79	350 110 110	600 260 260	11K3F1E 11K3F3E 20K0F1E 20K0F3E
	2	64 km around location 1		154.8300 155.4150 155.5500 159.0300	MO		110	110	20K0F3E
	3	30-9-6	99-32-6	155.0850 155.5500	FB2	83	110	320	20K0F3E
	4	29-55-28.9	99-1-20.8	155.0850 155.5500	FB2	15	110	310	20K0F3E
	5	30-3-19	99-3-50	155.0850 155.5500	FB2	61	110	310	20K0F3E
	6	6.1 m control stations		154.8300 159.0300	FX1		110	110	20K0F3E

KVF682—Call sign KVF682 is licensed by Kerr County and covers the operation of the four simulcast radio sites and simplex operation on TXLAW2. The license does not cover talkaround operation on the repeater transmit frequencies. The license reflects both wideband and narrowband analog operation.

5.10.3.7 System Coverage

L.R. Kimball notes that the Kerr County SO radio system has radio coverage issues. User reported coverage is as follows:

Table 202 – Kerr County SO User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	95%
Portable coverage	80%
In-building coverage	50%

The following coverage map depicts the predicted “talk out” portable coverage for the Kerr County SO radio system. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

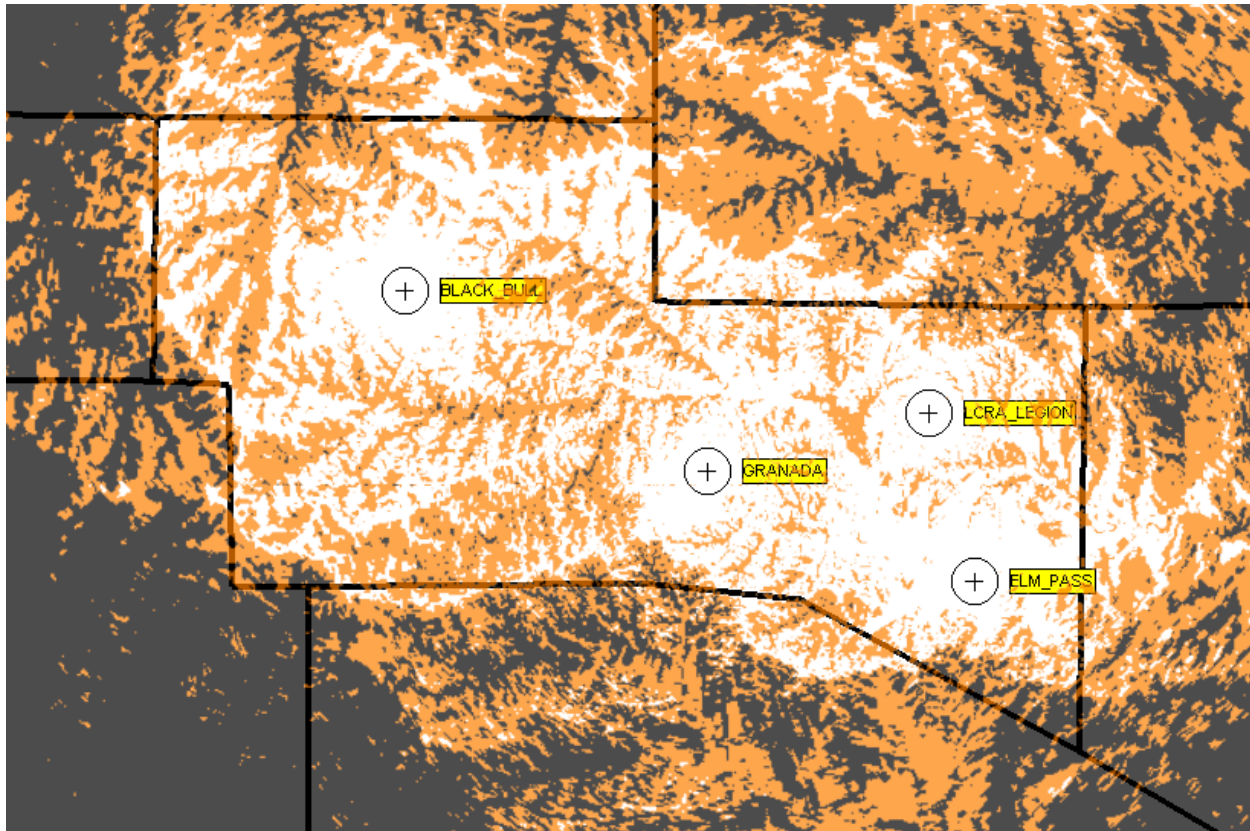


Figure 75 – Predicted Radio Coverage for Kerr County SO

Propagation studies indicate that the Kerr County SO radio system provides adequate portable coverage throughout Kerr County, with some localized coverage problems located in the southeast corner. Some intermittent coverage areas may be experienced in terrain-challenged areas in the western half of the county. In-building coverage will be found in the areas immediately surrounding radio sites.

5.10.3.8 Future Plans

Kerr County SO did not indicate future plans for the radio system.

5.10.3.9 Past Expenditures

Kerr County SO provided the following past radio expenditures:

Table 203 – Kerr County SO Past Expenditures

Year	Project Description	Total Cost	Funding Source
2007 – 2010	Dailey Wells Maintenance Contracts	\$82,125	
2007 – 2010	4-Tower leases	\$86,889.42	

Year	Project Description	Total Cost	Funding Source
2007 – 2010	Moving VFDs from KPD to KSO	\$3006	
2007 – 2010	Install low band radio in dispatch	\$1,000	
2007 – 2010	Repair of TXLAW2 Base Station	\$839.20	
2007 – 2010	Install KPD third radio head to third station	\$674.40	
2007 – 2010	Narrowband Ch 1 & 2	\$33,311	
2007 – 2010	Upgrade 2 Zetrons and add 1 new	\$44,250.00	
2008	Mobile and portable radios	\$90,665	SHSP Grant
2009	Mobile and portable radios	\$112,365.40	HSGP Grant
2009	TXLAW2 base upgrade	\$14,569	UASI Grant from San Antonio
2007-2010	Portable radios for Jail	\$9,788	
2007-2010	Replace batteries in UPSs at 4 tower sites	\$8,792.34	
2009	Portable radios	\$12,758.20	JAG Grant
Total		\$501,033	

5.10.3.10 Future Funding

Kerr County SO did not identify future funding opportunities.

5.10.3.11 Assessment

Interoperability—Interoperability today is achieved through the use of shared VHF channels. Primary dispatch frequencies for the surrounding VHF jurisdictions are programmed into fire/EMS radios. When an interoperability response is made, the responding user will switch to the frequency of whichever agency they are assisting. This method of interoperability is effective when capacity on the systems is not an issue and users are on the same frequency band. Public safety users within Kerr County are primarily in the VHF band and are able to communicate directly through the use of shared channels. However, other county users, including the utility departments and school districts, have no direct communications capabilities with first responders. A 900 MHz control station located at the SO PSAP provides connectivity to the LCRA EDACS system. No connectivity is currently in place in the 800 MHz band.

Split Resources—Presently, there are four distinct radio systems in use within Kerr County: the Kerr County SO system, the County fire system, the Kerrville FD system and the Kerrville PD system. Both the Kerrville FD and Kerr County Fire systems provide countywide coverage, but utilize separate radio equipment and radio sites. This diversification in resources limits the availability to enhance any one particular system, which could simultaneously solve the needs of all county users. The Kerr County SO system provides an equivalent countywide coverage area to systems utilized by the Kerrville FD and the Kerr County VFDs. Considerable cost savings can be recognized by reusing the same radio sites, or by building out a common radio system infrastructure.

Simulcast Overlap—Simulcast overlap problems occur where transmissions from two or more radio sites arrive at a radio subscriber unit out-of-phase, resulting in interference. These problems result from poorly timed simulcast

transmissions or when distance to the nearest radio site is great. Once a system is installed, the only remedy for correcting simulcast overlap problems is additional circuit tuning. Some simulcast overlap problems cannot be addressed without upgrading simulcast systems, or redesigning the system with additional radio sites.

End-of-life—The present conventional simulcast system was installed over ten years ago and is approaching the end of its operational life. Feedback indicated that the system has become less efficient over time. The need is recognized to replace the system before the current system is no longer operable. L. R. Kimball recognizes the age of the equipment, but notes that most of the individual system components are still supported by the equipment vendors. With proper maintenance the life of the equipment can be extended.

5.10.4 Radio System—Kerr County Fire

The Kerr County Fire system is a two-site VHF analog wideband system. A single repeater is located at each radio site. The two channels are referred to as FIRE COM MAIN and FIRE COM WEST. Additional VFD channels are maintained by the Ingram VFD and the Turtle Creek VFD. Equipment is primarily wideband-only; however, recent purchases have been made on P25-capable radios. The Ingram VFD is fully P25-capable.

5.10.4.1 User Agencies

The following agencies/entities utilize the Kerr County Fire radio system:

Table 204 – Kerr County Fire User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	Email
Kerr FD/EMS	Fire/EMS	Mark Beavers	830-257-8449	Mark.Beavers@kerrvilletx.gov
Kerr PD	Law Enforcement	Jeff Wendling	830-257-8181	Jeffrey.Wendling@kerrvilletx.gov
Kerr County SO	Law Enforcement	Clay Barton	830-896-1216	cbarton@co.kerr.tx.us
Ingram Marshal	Law Enforcement	Rowan Zachry	830-367-2636	Not Specified
Center Point VFD	Fire	Danny Smith	830-634-2323	Not Specified
Junction VFD	Fire	Lee Hall	325-446-8552	Not Specified
Comfort VFD	Fire	Daniel Morales	830-995-2124	Not Specified
Mountain Home VFD	Fire	Hank Poorman	830-866-3310	Not Specified
Elm Pass VFD	Fire		830-634-2083	Not Specified
Tierra Linda VFD	Fire	Mike Lannan	830-792-3533	Not Specified
Hunt VFD	Fire	Danny Feller	830-238-4371	Not Specified
Turtle Creek VFD	Fire	Mike Heath	830-257-3550	Not Specified
Ingram VFD	Fire	Ray Lynch	830-367-5641	Not Specified

5.10.4.2 Dispatch Facilities

Dispatch services for the fire system are provided individually by each VFD. Control stations permit operators at the stations to contact remote users. In the absence of staffed personnel at the VFDs, dispatch services are provided by the Kerr County SO dispatch center.

Channels appearing on the console include:

Table 205 – Kerr County Fire Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
FIRE COM MAIN	Volunteer Fire Dispatch (Main)
Fire Com West	Volunteer Fire Dispatch (West)

5.10.4.3 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

Coverage—Users on the Kerr County fire system reported serious coverage problems on the system. Coverage on the Ingram VFD channel only provides mobile coverage over in half of the service district.

Capacity—Capacity on the system is limited to the single shared dispatch channels. Additional channels are needed to manage on-scene operations.

P25—Most of the VFDs do not have sufficient funding for P25 radio purchases. Much of the present equipment is aging and needs to be replaced. Some equipment is not narrowband capable and, at a minimum, must be replaced prior to 2013 to meet the narrowbanding mandate.

5.10.4.4 Radio Sites

Kerr County Fire provided the following radio site information:

Table 206 – Kerr County Fire Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
FIRE COM MAIN	Granada Site	LCRA	Unknown	
FIRE COM WEST	Highway 41 Hall Ranch	Central Texas Electrical Coop	Unknown	
Ingram FD	215 Highway 39 Ingram TX	Ingram VFD	6 Months	Y
Smokey Mountain	End of Fifth St, Kerrville, TX	Advantage Communications	14 Years	Y

Kerr County Fire provided the following radio shelter information:

Table 207 – Kerr County Fire Radio Shelters

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
FIRE COM MAIN					
FIRE COM WEST					
Ingram FD	10' X 18'	Wood/Metal	6 Years	Y	Y
Smokey Mountain	10' X 14'	Concrete Brick	1995	Y	Y

5.10.4.5 Radio Inventory

Kerr County Fire provided the following radio equipment information:

Table 208 – Kerr County Fire Radio Equipment

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
FIRE COM MAIN	Repeater			152.1500 / 158.6100
FIRE COM WEST	Repeater			152.0600 / 158.5200
Ingram FD	Repeater			154.1750
Smokey Mountain	Repeater			154.1750

Table 209 – Kerr County Fire Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Divide VFD	Motorola	PM-400	Mobile	35 (estimate)
	Motorola	PR-400	Portable	
	Motorola	Radius	Mobile	
	Motorola	1225	Portable	
	Motorola	SP 50	Portable	
	Motorola	1225	Control Station	
	Motorola	Radius	Control Station	
	Motorola	PM-400	Control Station	
Mt Home VFD	Motorola	PM-400	Mobile	35 (estimate)
	Motorola	PR-400	Portable	
	Motorola	Radius	Mobile	
	Motorola	1225	Portable	

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
	Motorola	SP 50	Portable	
	Motorola	1225	Control Station	
	Motorola	Radius	Control Station	
	Motorola	PM-400	Control Station	
Ingram VFD	Motorola	PM-400	Mobile	12
	Motorola	PR-400	Portable	17
	Motorola	Radius	Mobile	6
	Relm		Portable	6
	Motorola	SP 50	Portable	4
	Motorola	1225	Control Station	3
	Motorola	Radius	Control Station	1
	Motorola	PM-400	Control Station	1
	Motorola	XTS2500	Portable	9
	Motorola	XTS1500	Mobile	9
	Motorola	XTL1500	Control Station	1
Center Point VFD				35 (estimate)
Junction VFD				35 (estimate)
Comfort VFD				35 (estimate)
Mount Home VFD				35 (estimate)
Elm Pass VFD	Not Provided	Not Provided	Mobile	4
	Not Provided	Not Provided	Portable	10
Tierra Linda VFD	Not Provided	Analog VHF NB Capable	Mobile	7
	Not Provided	VHF P25 Capable	Mobile	1
	Not Provided	Analog VHF NB Capable	Portable	14
Hunt VFD				35 (estimate)
Turtle Creek VFD	Motorola	HT1250	Portable	1
	Motorola	HT1000	Portable	4
	Motorola	SM120	Mobile	5
Total Portables				60
Total Mobiles				44
Total Control Stations				6
Reported Subscribers – Total				110
Estimate for Unreported Subscribers – Total				345

5.10.4.6 FCC Licenses

Table 210 – Kerr County Fire FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WPKI374	1	29-58-59.8	99-13-42.2	154.3250	FB	30	40	100	20K0F3E
	2	29-58-42.8	99-13-1.1	154.3250	FB2	25	100	200	20K0F3E
	3	24 km around location 2		150.7750 154.3250	MO		40		20K0F3E
KNFC853	1	Kerr County Texas		154.1750	MO		90		20K0F3E
	2	30-3-50.8	99-10-9.2	154.1750	FB	24	90		20K0F3E
WPWM367	1	30-3-50.8	99-10-9.2	154.1750	FB	15	90	125	20K0F3E
	2	32 km around location 1					45	45	20K0F3E
WQMX427		BEA134 – San Antonio TX		152.1500 158.6100					

WPKI374—Call sign WPKI374 is licensed by the Turtle Creek VFD and covers operation of a single repeater frequency pair used for on-scene tactical fire operations. The license covers the operation of a simplex base station on the repeater transmit frequency instead of a control station on the mobile frequency. Separate mobile lines are included for 5 W and 40 W operations; however, the 40 W line also covers the operation of 5 W mobile. The license covers wideband analog operation, and must be updated with narrowband emissions prior to January 1, 2013.

KNFC853 and WPWM367—Call signs KNFC853 and WPWM367 are licensed by the Ingram VFD and cover operation of the simplex frequency 154.1750 at the Ingram VFD. The license covers base and mobile operation. The call sign KNFC853 expired in 2002 and call sign WPWM367 replaced the license. The license does not yet reflect repeater operation at the Ingram VFD tower. The license reflects wideband analog operation and must be updated to reflect narrowband and P25 operations. Narrowband emissions must be added prior to January 1, 2013.

WQMX425—Call sign WQMX425 is licensed by Sherman, Arthur N, and covers the operation of the FIRE COM WEST channel. The license is in radio service CP for Part 22 paging. Agreements were made between Kerr County and the licensee to utilize the channel in Kerr County. However, Kerr County does not hold a license for the channel. The license does not authorize the use of the frequencies for land/mobile radio communication. Public safety users may acquire Part 22 paging channels; however, a major waiver must be filed with the FCC, which must include documentation to support that no other public safety primary channels are available.

WQMX427—Call sign WQMX427 is licensed by Sherman, Arthur N, and covers the operation of the FIRE COM MAIN channel. The license is in radio service CP for Part 22 paging. Agreements were made between Kerr County

and the licensee to utilize the channel in Kerr County. However, Kerr County does not hold a license for the channel. The license does not authorize the use of the frequencies for land/mobile radio communication. Public safety users may acquire Part 22 paging channels; however, a major waiver must be filed with the FCC, which must include documentation to support that no other public safety primary channels are available.

5.10.4.7 System Coverage

Kerr County Fire did not provide user reported coverage.

The following coverage map depicts the predicted “talk out” portable coverage for the Kerr County Fire radio system. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

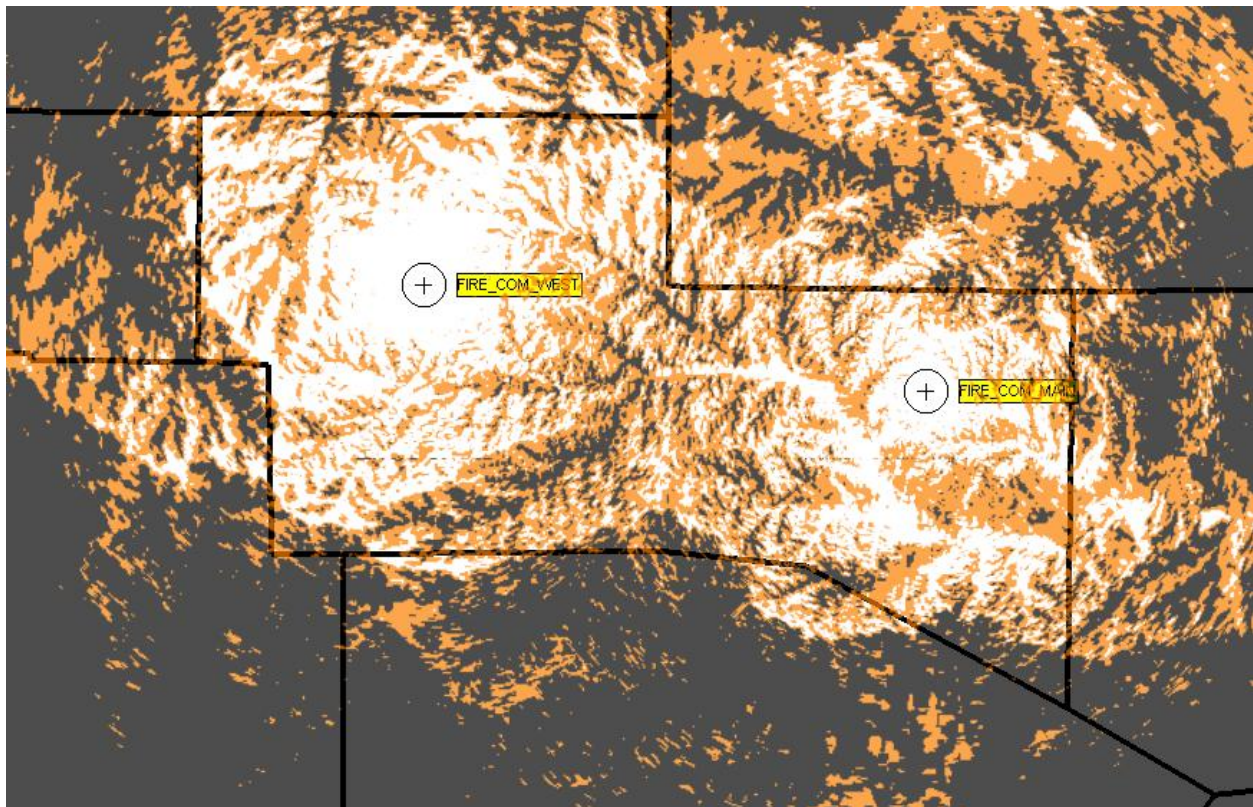


Figure 76 – Predicted Radio Coverage for Kerr County Fire

Coverage on the system is adequate throughout most of the county, with coverage problems located southeast of Kerrville and in terrain-challenged areas in the center of the county. Coverage is problematic along the lower fork of the Guadalupe River along Highway 39.

5.10.4.8 Future Plans

Kerr County Fire indicated the following future plans:

P25 Upgrades—All VFDs in Kerr County are in the process of replacing aging wideband subscribers with P25-capable radios.

Repeater—Plans are in place to relocate the Ingram primary repeater from the Smoke Mt site to the Ingram VFD. The relocation will improve coverage in the Ingram area. Plans are also in place to upgrade the Ingram VFD simplex channel to a repeater.

Tower Upgrade—Plans are in place to upgrade the tower at the Ingram VFD to 150 feet.

5.10.4.9 Past Expenditures

Kerr County Fire provided the following past radio expenditures:

Table 211 – Kerr County Fire Past Expenditures

Year	Project Description	Total Cost	Funding Source
2007 – 2010	Divide VFD – Radio Purchases and Repairs		Local Budget
2007 – 2010	Divide VFD – Radio Purchases and Repairs		Local Budget
2007 – 2010	Ingram VFD - Communications	\$15,000	Local Budget
2010	Upgrade Ingram FD Subscribers to P25	\$34,027	HLS Grant
Total		\$49,027	

5.10.4.10 Future Funding

Kerr County Fire did not identify future funding opportunities.

5.10.4.11 Assessment

Split Resources—Presently, there are four distinct radio systems in use within Kerr County: the Kerr County SO system, the County fire system, the Kerrville FD system and the Kerrville PD system. Both the Kerrville FD and Kerr County Fire systems provide countywide coverage, but utilize separate radio equipment and radio sites. This diversification in resources limits the availability to enhance any one particular system, which could simultaneously solve the needs of all county users. User feedback from VFDs indicated that additional channels were needed to handle multiple fire incidents. With the number of sites and channels in place, capacity should not be a problem. A considerable amount of funding has been spent within the county to upgrade subscribers and infrastructure to public safety-grade equipment that is both narrowbanding and P25-compliant. Additional funding is planned to upgrade the Kerrville FD system to simulcast. Considerable savings could be recognized by combining radio sites that provide equivalent coverage areas, and implementing a common shared conventional simulcast or trunking system. County VFDs are not utilizing fully P25-compliant subscriber fleets and thus cannot access Kerrville FD repeaters operating in the P25 mode.

Interoperability—Interoperability today is achieved through the use of shared VHF channels. Primary dispatch frequencies for the surrounding VHF jurisdictions are programmed into fire/EMS radios. When an interoperability response is made, the responding user will switch to the frequency of whichever agency they are assisting. This method of interoperability is effective when capacity on the systems is not an issue and the users are on the same frequency band. Public safety users within Kerr County are primarily in the VHF band and are able to communicate directly through the use of shared channels. However, other county users, including the utility departments and school districts, have no direct communications capabilities with first responders. A 900 MHz control station located at the SO PSAP provides connectivity to the LCRA EDACS system. No connectivity is currently in place in the 800 MHz band.

Conventional Architecture—The present Kerrville FD radio system utilizes a conventional architecture, requiring radio users to switch channels to access different repeater sites. The plans in place to simulcast the three repeaters will solve this problem, permitting seamless roaming from site to site. A trunking system will also provide site-to-site roaming capabilities.

Aging Equipment—VFDs within Kerr County still utilize a preponderance of aging wideband radios. These radios will not meet the narrowbanding deadline and will not meet the State goals for P25 compliance by 2015. While plans are in place to upgrade the aging equipment to P25, funding has not been secured for these upgrades. VFD funding is primarily from local funds, which are insufficient to support a full P25 upgrade.

5.10.5 Radio System—Ingram City Marshall

The city of Ingram operates a single repeater utilized for law enforcement and public works operations. The repeater is located at the Smokey Mt site in Kerrville. The system is conventional analog and P25. Plans are in place to relocate the repeater to the Ingram VFD tower once the height has been increased to 150 feet. Equipment is primarily Motorola, and the system utilizes the Motorola proprietary ADP encryption.

5.10.5.1 User Agencies

The following agencies/entities utilize the Ingram radio system:

Table 212 – Ingram User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	Email
Ingram Marshal's Department	Law Enforcement	Rowan Zachry	830-367-2636	rzachry@ingramtx.com
City of Ingram	Public Works	Rowan Zachry	830-367-2636	rzachry@ingramtx.com
Ingram VFD	Fire	Rowan Zachry	830-367-2636	rzachry@ingramtx.com
Kerr County SO	Law Enforcement	Clay Barton	830-896-1316	
Kerrville PD	Law Enforcement	Bill Price	830-257-8181	
Kerrville FD	Fire/EMS	Tony Leonard		

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	Email
TXDPS	Law Enforcement			
Kerr County VFDs				

5.10.5.2 Dispatch Facilities

Dispatch for the Ingram system is performed at the Ingram City Marshall's Office utilizing a desktop control station. Dispatch is provided during the day. After-hours dispatch is provided by the Kerr County SO.

Channels appearing on the console include:

Table 213 – Ingram Dispatch Console Channels

Channel Names as Appearing on Console	Description (e.g., Sheriff Primary Dispatch, Volunteer Fire, Tactical, etc.)
Ingram A/D	Ingram Marshall's Department

5.10.5.3 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

Coverage—The present Ingram repeater is located on the primary Kerrville tower site and provides mediocre coverage in the Ingram area. The relocation of the repeater to the Ingram VFD tower should improve coverage in the Ingram area.

Console—The Ingram Marshall's Office utilizes a desktop control station instead of a multi-channel console. A console is needed to expand channel capacity.

Repeater Replacement—A need was identified to replace the current Motorola Quantar repeater utilized by Ingram.

P25 Upgrades—A need was expressed to upgrade public works subscribers to P25 in order to operate on the Ingram repeater in a P25 mode.

Public Works Laptops—A need was expressed to upgrade data links to provide MDT operation and upgrade in-vehicle laptops.

5.10.5.4 Radio Sites

Ingram provided the following radio site information:

Table 214 – Ingram Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Smokey Mountain	End of Fifth Street, Kerrville, TX	Advantage Communications	14 Years	Y
Ingram FD	215 Highway 39, Ingram, TX	Ingram FD	6 Months	Y

Ingram provided the following radio shelter information:

Table 215 – Ingram Radio Shelters

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
Smokey Mountain	10' X 10'	Concrete Brick	1995	Y	Y
Ingram FD	10' X 14'	Inside Main Building Adjacent to Radio Tower	2006	Y	Y

5.10.5.5 Radio Inventory

Ingram provided the following radio equipment information:

Table 216 – Ingram Radio Equipment

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
Smokey Mountain	Repeater	Motorola	Quantar	VHF
Smokey Mountain	Duplexer			

Table 217 – Ingram Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Ingram Marshal's Department	Motorola	XTS 2500	Portable	7
	Motorola	XTL 1500	Mobile	6
	Motorola	XTL 1500	Control Station	2
	Motorola	PR 400	Portable	5
	Motorola	PM 400	Mobile	5
	Motorola	PM 400	Control Station	1
Total Portables				12
Total Mobiles				11

Total Control Stations	3
Total	26

5.10.5.6 FCC Licenses

Table 218 – Ingram FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WPFJ638	1	30-2-37.7	99-7-17.1	155.1150	FB2	61	100	160	11K3F1D 11K3F1E 11K3F3E 20K0F1E 20K0F3E
	2	Ingram TX		155.1150 158.9250	MO		90	80	11K3F1D 11K3F1E 11K3F3E 20K0F1E 20K0F3E

WPFJ638—Call sign WPFJ638 is licensed by the city of Ingram and covers repeater operation at the Smokey Mt site in Kerrville. The license covers talkaround operation, but does not cover control stations. The license does not reflect the P25 emissions 8K10F1D and 8K10F1E.

5.10.5.7 System Coverage

User reported coverage is as follows:

Table 219 – Ingram User Reported Coverage

Radio System Coverage Levels	
Mobile coverage	95%
Portable coverage	60%
In-building coverage	40%

The following coverage map depicts the predicted “talk out” portable coverage for the Ingram radio system. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

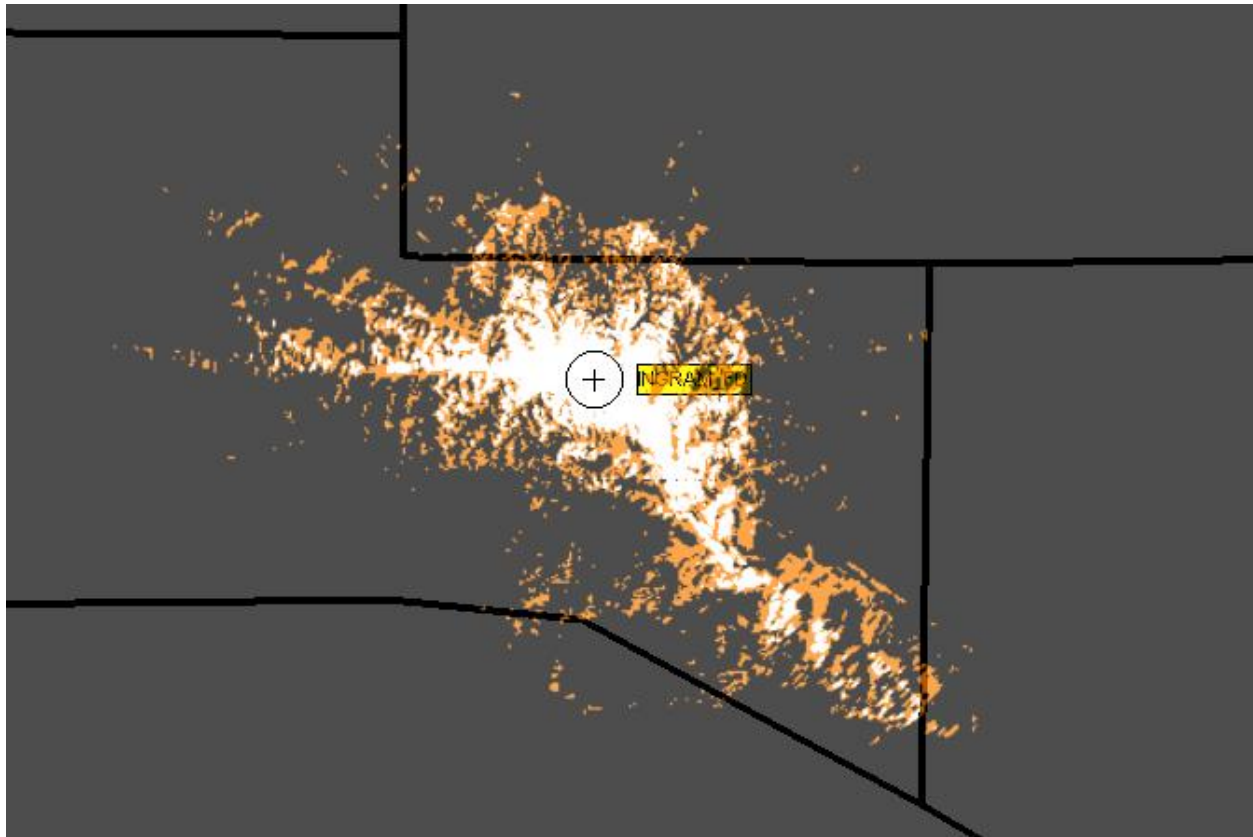


Figure 77 – Predicted Radio Coverage for Ingram

The Ingram FD radio site provides adequate coverage in the areas immediately surrounding the city of Ingram. Wide area coverage is limited. The radio coverage propagates along the valley, and does not overcome the surrounding terrain obstacles.

5.10.5.8 Future Plans

Ingram indicated the following future plans:

Console Upgrade—A console upgrade is planned to permit multi-frequency usage from the Ingram Marshall's Office.

Repeater Replacement—A replacement is planned for the existing Quantar base station and associated duplexer.

P25 Upgrades—Replacement radios are planned for Public Works to operate on the Ingram repeater in P25 mode.

Laptop Upgrades—Laptop upgrades are planned for Public Works.

5.10.5.9 Past Expenditures

Ingram provided the following past radio expenditures:

Table 220 – Ingram Past Expenditures

Year	Project Description	Total Cost	Funding Source
2007 – 2010	Communications Costs	\$20,000	Local Budget
2008	Radio Upgrade P25 (L/E)	\$27,051	SHSP LEAPGRANT
2010	Portable Radio Upgrade P25	\$8,155	HLS Grant
Total		\$55,206	

5.10.5.10 Future Funding

Ingram did not identify future funding opportunities.

5.10.5.11 Assessment

Coverage—Coverage for the existing Ingram system is centered at the primary Kerrville site, which is east of the city of Ingram. The planned move of the repeater to the Ingram VFD will improve portable and in-building coverage in the Ingram area; however, the site is located within a valley and will not provide wide area coverage.

Interoperability—Interoperability gaps were identified with the Ingram Interdependent School District and the utility companies. Interoperability can be achieved through a console patch or other gateway; however, the Ingram school districts are not tied into any public safety consoles. Interoperability is limited with 800 MHz users who could potentially respond to the area from San Antonio for an interoperability event.

Console—The present dispatch solution utilizing a desktop control station limits the ability of Ingram dispatchers to monitor traffic from both the primary SO and Ingram channels. The inability to monitor the traffic limits the situational awareness of Ingram dispatchers to radio incidents occurring elsewhere.

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5.11 Medina County

Medina County, with an estimated 2009 population of 44,728, is located in the eastern portion of the AACOG. The county is 1335 square miles, of which 7 square miles is water. The cities of Castroville, Devine, Hondo, LaCoste, Lytle and Natalia, as well as various unincorporated areas, comprise the county.

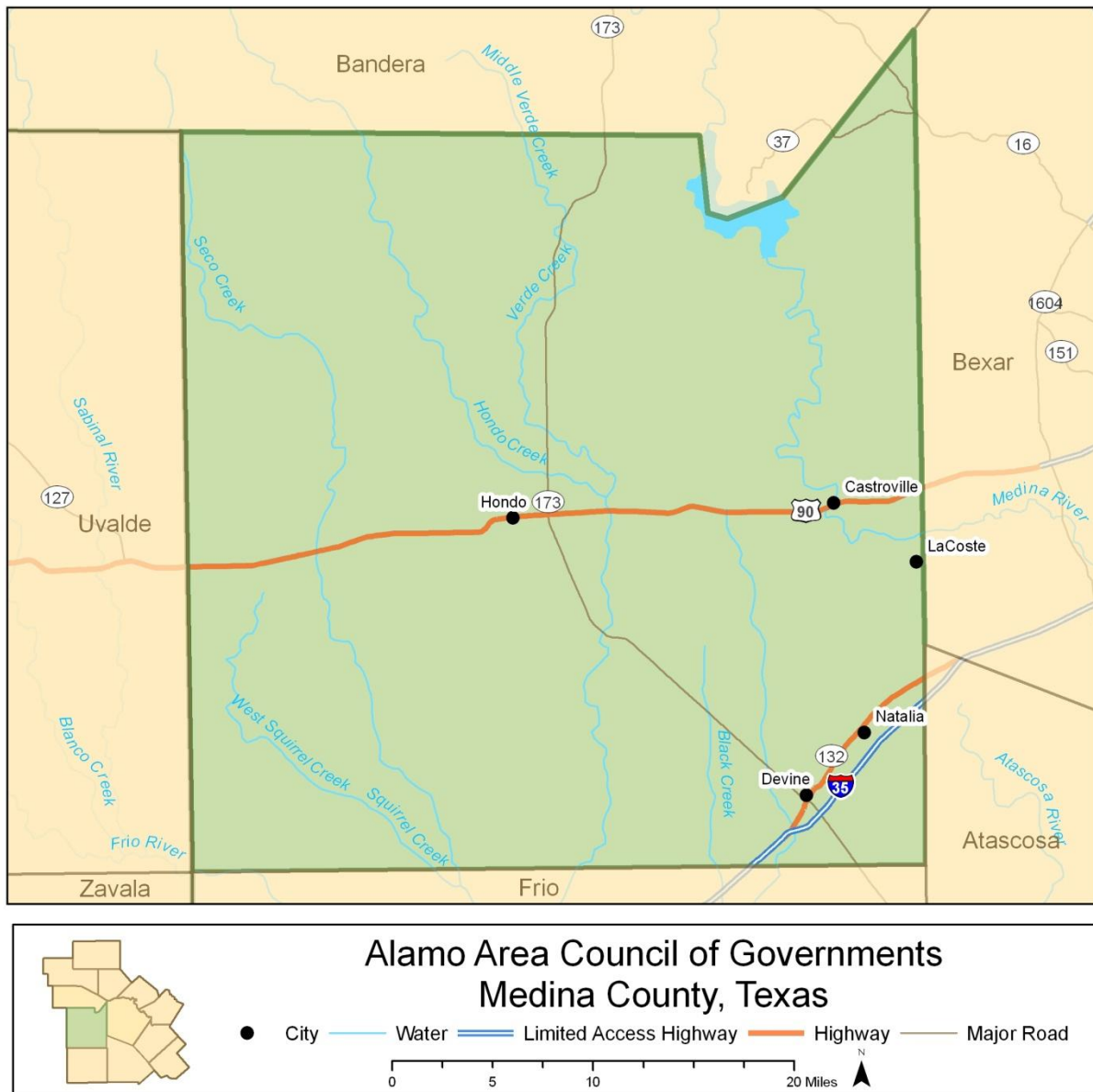


Figure 78 – Medina County

Medina County includes conventional VHF systems operated by Medina County, Devine, and Hondo. Supplementary systems are managed by Castroville, and Natalia VFD. Plans are in place to migrate all emergency responders within Medina County to a shared VHF P25 trunked system. Interviews have not been conducted with representatives of Medina County, and the data provided regarding the present and future systems is based on publicly available information and several conversations held with County representatives.

5.11.1 Radio System—Medina County

The Medina County radio system currently utilizes VHF conventional repeater sites operated by multiple agencies at locations throughout the county. Existing systems operate in the wideband analog mode. Plans are in place to implement a shared VHF P25 trunking system for all emergency responders in Medina County. FCC licenses indicate that the system will utilize multi-cast technology, with different frequencies at each radio site. The system will use a total of 15 frequencies at five locations. The number of frequencies at each location ranges from two to five.

5.11.1.1 User Agencies

Medina County did not provide user agencies.

5.11.1.2 Dispatch Facilities

Medina County did not provide dispatch or console information.

5.11.1.3 Focus Groups

Medina County did not provide feedback on the radio system.

5.11.1.4 Radio Sites

Table 221 – Medina County Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Hondo	91M S Old 90, 12 KM E, Hondo, TX			
Natalia				
D'Hanis				
Mico				
Castroville				

Table 222 – Medina County Radio Shelters

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
Hondo					
Natalia	.70 miles West				

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
	of Natalia, Natalia, TX				
D'Hanis	5 miles west of D'Hanis and 2.1 miles N of Highway 90, D'Hanis, TX				
Mico	7121 CR 271, Mico, TX				
Castroville	.71 Miles SW Of Castroville, Castroville, TX				

5.11.1.5 Radio Inventory

Medina County did not provide radio equipment information.

5.11.1.6 FCC Licenses

Table 223 – Medina County FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
WQEU654	1	29-20-46.8	99-0-59.1	155.8125 155.5275 155.7825 155.9325 155.8950	FB8	64	110	194	11K2F1D 11K2F1E 11K2F3E
	2	Medina County		158.8875 158.9025 158.9325 158.9625 159.0375	MO8		100	150	11K2F1D 11K2F1E 11K2F3E
WQEZ337	1	29-11-20	98-51-3.2	155.5725 155.7975 158.8275	FB8	47.9	110	188	11K2F1D 11K2F1E 11K2F3E
	2	40 km around location 1		154.7175 154.7775 154.6575	MO8		100	150	11K2F1D 11K2F1E 11K2F3E
WQEZ464	1	29-20-42	99-21-39	155.0175 155.0775	FB8	96.9	110	232	11K2F1D 11K2F1E 11K2F3E
	2	40 km		155.6175	MO8		100	150	11K2F1D

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
		around location 1		155.6325					11K2F1E 11K2F3E
WQFG832	1	29-32-30.8	98-55-31.1	155.1375 155.1975	FB8	18.3	100	70	11K2F1D 11K2F1E 11K2F3E
	2	24 km around location 1		155.6775 155.6925	MO8		100	150	11K2F1D 11K2F1E 11K2F3E
WQGW269	1	29-20-53.3	98-53-11.7	155.7675 155.3025 155.9250	FB8	15.2	110	88	11K2F1D 11K2F1E 11K2F3E
	2	32 km around location 1		158.9250 158.8650 154.055	MO8		25	25	11K2F1D 11K2F1E 11K2F3E

WQEU654—Call sign WQEU654 is licensed by the Medina County SO and covers the operation of five trunked VHF repeater pairs at the primary radio site in Hondo. The license reflects narrowband emissions, but does not reflect P25 emissions. The P25 emissions 8K10F1D and 8K10F1E need to be added to the license. The license does not cover talkaround or control station operation.

WQEZ337—Call sign WQEZ337 is licensed by the city of Natalia and covers the operation of three trunked VHF repeater pairs in Natalia. The license reflects narrowband emissions, but does not reflect P25 emissions. The P25 emissions 8K10F1D and 8K10F1E need to be added to the license. The license does not cover talkaround or control station operation.

WQEZ464—Call sign WQEZ464 is licensed by the city of D'Hanis VFD and covers the operation of two trunked VHF repeater pairs at a radio site in D'Hanis. The license reflects narrowband emissions, but does not reflect P25 emissions. The P25 emissions 8K10F1D and 8K10F1E need to be added to the license. The license does not cover talkaround or control station operation. Trunked operation on two channels will be limited to one operational channel and one control channel.

WQFG832—Call sign WQFG832 is licensed by the Mico VFD and covers the operation of two trunked VHF repeater pairs at a radio site in Mico. The license reflects narrowband emissions, but does not reflect P25 emissions. The P25 emissions 8K10F1D and 8K10F1E need to be added to the license. The license does not cover talkaround or control station operation. Trunked operation on two channels will be limited to one operational channel and one control channel.

WQGW269—Call sign WQGW269 is licensed by the city of Castroville and covers the operation of two trunked VHF repeater pairs at a radio site in Castroville. The license reflects narrowband emissions, but does not reflect P25 emissions. The P25 emissions 8K10F1D and 8K10F1E need to be added to the license. The license does not cover talkaround or control station operation.

5.11.1.7 System Coverage

Medina County did not provide user reported coverage.

The following coverage map depicts the predicted “talk out” portable coverage for the pending P25 trunked VHF radio system in Medina County. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage.

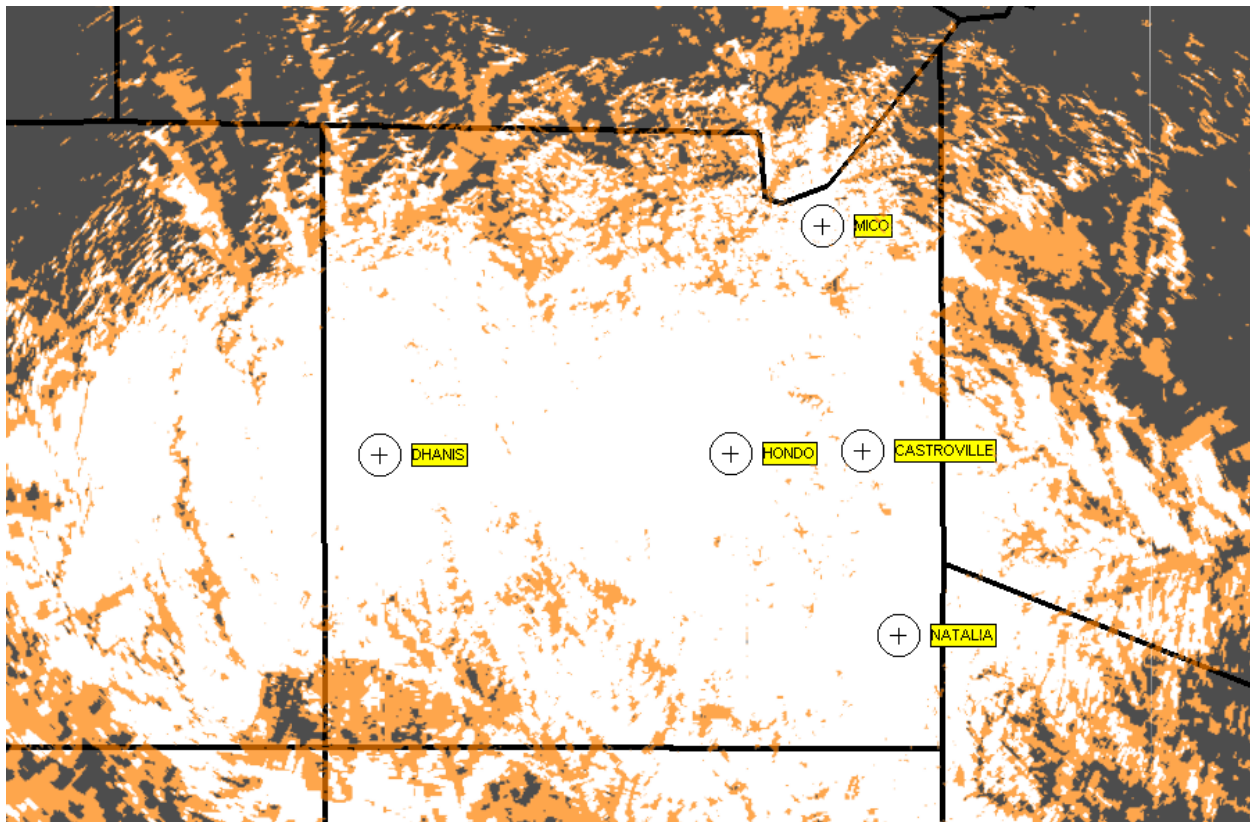


Figure 79 – Predicted Radio Coverage for Proposed Medina County System

Propagation analysis indicates adequate portable coverage on the proposed radio sites for the Medina County VHF trunking system. Some coverage problems will likely exist along the northern county border.

5.11.1.8 Future Plans

Medina County did not provide future plans for the radio system.

5.11.1.9 Past Expenditures

Medina County did not provide past radio expenditures.

5.11.1.10 Future Funding

Medina County did not identify future funding opportunities.

5.11.1.11 Assessment

VHF Trunking—VHF trunking systems present numerous challenges resulting from frequency separation and interference. Even when licensed, VHF trunking systems are prone to receiver desense from inadequate frequency pairings and interference from neighboring co-channel or adjacent-channel systems. Because the present radio system is limited to a maximum of five channels per site and does not use simulcast, chances are improved that system design challenges will not be significant.

Capacity—Capacity on the system is limited to as little as two frequencies at some locations. In a trunking system, one channel is traditionally utilized as the control channel and the remaining channels are utilized for voice traffic. With a two-channel radio site, only one channel will be available for voice traffic. The potential exists for a roaming user on a SO talk group to occupy the single channel and lock out response from the local FD. In this circumstance capacity could be more restrictive than experienced on a conventional system because there will be no ability for users to “talk over each other.” Users on a trunking system do not monitor all talk groups, and will thus not know when a channel is busy. Some trunking technologies permit voice traffic on the control channel when all other talk groups are busy. This feature is recommended for radio sites with limited channel capacity.

Coverage—Proposed coverage for the radio system is sufficient throughout most of the county, but there are problem areas along the northern county border and in the southwest corner. Additional radio sites will likely be necessary if portable coverage is needed in these areas.

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5.12 Wilson County

Wilson County, with an estimated 2009 population of 40,749, is located in the eastern portion of the AACOG. The county is 809 square miles, of which 2 square miles is water. The county is comprised of various towns and cities including Floresville, Poth and Stockdale.

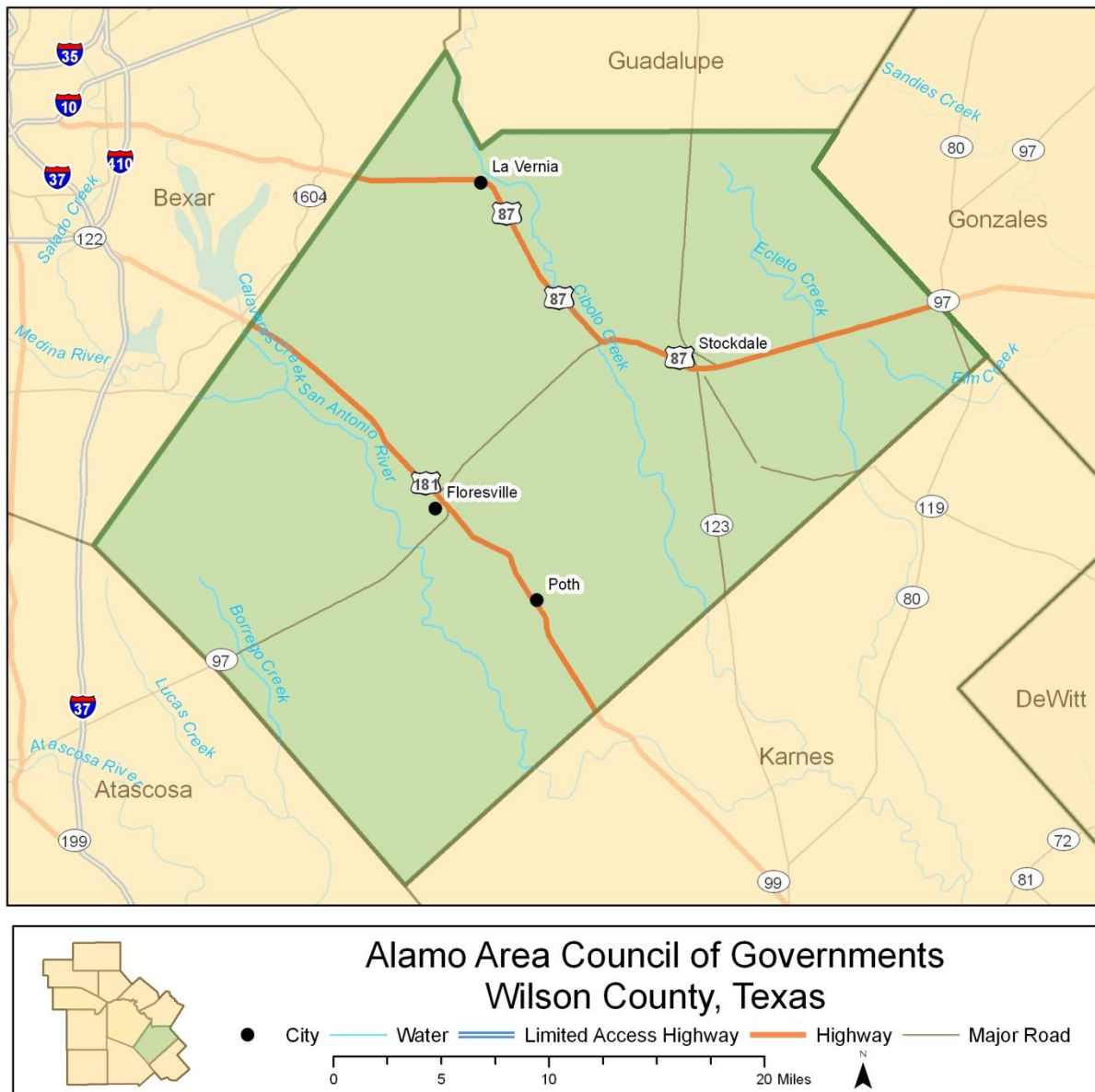


Figure 80 - Wilson County

Radio systems within Wilson County include a single VHF conventional system using a single transmitter location with voted receivers. The system provides P25 digital service on the SO channel and analog service on the fire/EMS channel.

5.12.1 Radio System—Wilson County

The Wilson County radio system is an analog and digital VHF conventional system with a primary transmitter located at Floresville tower site. The primary site includes two base stations: one P25 digital for the primary SO dispatch channel and one analog for fire/EMS dispatch. All SO radios are P25 digital-capable. Fire/EMS subscriber radios are from a mix of equipment vendors. Voted receivers are utilized to enhance talk back coverage on the P25 system. Multiple radio sites are implemented on the same frequency for dispatch operation; however, they are not arranged in a simulcast configuration. Approximately one half of the fire/EMS radios are not narrowbanding capable and must be replaced prior to 2013. The system utilizes satellite receivers to vote audio on the primary dispatch channel from multiple radio sites. Secondary tactical channels are utilized by the La Vernia and Stockdale FDs.

5.12.1.1 User Agencies

The following agencies/entities utilize the Wilson County radio system:

Table 224 – Wilson County User Agencies

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Wilson County SO	Law Enforcement	Joe Tackitt Jr. (Sheriff)	830-393-2535	smoy@wcsotx.org
Floresville PD	Law Enforcement	Jesse Evins (Assistant Chief)	830-393-4055	
La Vernia PD	Law Enforcement	Bobby Hyatt (Chief)	830-779-4541 EXT.5	laverniapd@lavernia.net
Poth PD	Law Enforcement	Lambert Jendrzey (Chief)	830-484-0281	chief51@tgti.net
Stockdale FD	Fire	Edwin Baker	830-391-1713	chiefsfd4100@gmail.com
La Vernia FD	Fire	Jason Scheel	830-779-2438	lvchief3100@yahoo.com
Floresville FD	Fire	Lorenzo Ortiz	210-415-8125	lysa@felipsis.net
Poth FD	Fire	Lawrence Jansky	830-484-3723 (W) 830-484-3777 (H)	
Kicaster FD	Fire	Bruce Engelke	830-947-0041 (H)	bwengelke2u@yahoo.com
Sutherland Springs FD	Fire	William Barnes	210-844-4994	will@sutherlandspringsvfd.com
Eagle Creek VES	Fire/EMS	Ed and Shirley Schriber	830-393-7283	code03shur2001@yahoo.com
Three Oaks FD	Fire	Randy Ortman	830-534-8599	

Agency Name	Agency Category (Law Enforcement, Fire, EMS, etc.)	Point of Contact		
		Name	Phone Number	E-mail
Stockdale EMS	EMS	David Rice	830-391-3448	ricedw@live.com
Wilson County VAA	EMS	Mary Hernandez	830-393-3120	wcvaa@txun.net
La Vernia EMS	EMS	Ronnie Rye	830-391-0412	ronnierye@yahoo.com
Wilson County OEM	Emergency Management	LeAnn Hosek	210-313-4425	leannema@felipsis.net

5.12.1.2 Dispatch Facilities

Channels appearing on the console include:

Table 225 – Wilson County Dispatch Console Channels

Channel Names as Appearing on Console	Description (Sheriff Primary Dispatch, VFD Tactical, etc.)
Wilson County SO Digital	Sheriff Department Primary
Wilson County SO Analog	Fire and EMS Dispatch

5.12.1.3 Focus Groups

The following are key points documented by L.R. Kimball during focus group sessions:

Coverage—Coverage estimates for the Wilson County system are 90 percent mobile and 70 percent portable. Coverage problems are reported to be minor in nature. It is estimated that three additional transmitter locations are needed to fill coverage gaps.

Capacity—Capacity is a major problem on the current Wilson County system, with severe capacity limitations occurring on a regular basis. It is estimated that two additional channels are needed to provide adequate capacity.

Interoperability—Interoperability gaps exist between Wilson County and the Texas Forest Service, TXDOT, Stockdale Independent School District (ISD), Connally Memorial Medical Center, RMOC, City Halls in the county, DPS, Floresville ISD, La Vernia ISD, and EOCs in AACOG region, FEMA, ARC, SOC, Poth ISD, Public Health Region 8, STRAC, and NWS. Interoperability gaps are the result of a lack of shared channels, a lack of SOPs, and a lack of gateways to interconnect systems in different frequency bands.

Funding—Future planning for the system is limited, primarily due to a lack of funding.

5.12.1.4 Radio Site

Wilson County provided the following radio site information:

Table 226 – Wilson County Radio Sites

Site Name	Address	Tower Owner	Tower Age	Available for Expanded Use?
Poth Water Tower	1105 Griffith St., Poth	City of Poth	Leased-Unknown	N
Stockdale Water Tower	U S Hwy 87 Bypass, Stockdale	City of Stockdale	Leased-Unknown	Y
Kicaster Tower	CR 324	Horizon	Leased-Unknown	N
Floresville Tower	CR 401	Texas Parks and Wildlife	Leased-Unknown	N
SS Water Tower Site	Tower Trail Dr	SS Water Supply Corp	Leased-Unknown	N

Wilson County provided the following radio shelter information:

Table 227 – Wilson County Radio Shelters

Site Name	Shelter Dimensions	Shelter Construction (concrete, wood, etc.)	Year Shelter Installed	HVAC Systems? (Y/N)	Room for Additional Systems? (Y/N)
Poth Water Tower Site	6'x6'	Wood w/tin roof	2008	Y Window Unit	Y
Stockdale Water Tower Site	6'x6'	Wood w/tin roof	2008	Y Window Unit	Y
SS Water Tower	6'x6'	Wood w/tin roof	2007	Y Window Unit	Not Specified
Floresville Water Tower	8'x10'	All Metal	2002	Y Window Unit	Not Specified
Kicaster Tower	10'x20'	All Metal	2000	Y Window Unit	N

5.12.1.5 Radio Inventory

Wilson County provided the following radio equipment information:

Table 228 – Wilson County Radio Equipment

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
Poth Water Tower	Repeater	Motorola	MTR2000	155.55
Stockdale Water Tower	Repeater	Motorola	MTR2000	155.55

Site Name	Equipment Type (repeater, combiner, etc.)	Equipment Manufacturer	Equipment Model	Frequency
Kicaster Tower	Repeater	Unknown	Unknown	155.55
Floresville Tower	Analog Repeater	Kenwood	Unknown	155.55
Floresville Tower	Digital Repeater	Motorola	Unknown	153.8825
SS Water Tower	Voting receiver	Motorola	Unknown	155.6625

Table 229 – Wilson County Subscriber Equipment

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Constable, Pct 1-4	ICOM		Mobile	4
	ICOM	ICF70DS	Portable	4
Stockdale Fire and EMS	Motorola	CDM1550LS	Mobile	3
	Motorola	CDM1550	Mobile	4
	Motorola	CDM1250	Mobile	4
	Motorola	RADIUS 1225	Mobile	4
	Kenwood	TK5210	Mobile	1
	ICOM	IC700	Mobile	2
	Motorola	HT750	Portable	20
	Motorola	HT1250	Portable	5
	Kenwood	TK5210K7	Portable	4
Floresville Fire	Motorola	RADIUS M1225	Mobile	3
	Motorola	MAXTRAC 300	Mobile	4
	Motorola	PM400	Mobile	1
	Motorola	RADIUS GM300	Mobile	1
	Motorola	RADIUS P110	Portable	2
	Kenwood	TK260G	Portable	6
	Kenwood	TK260	Portable	5
La Vernia Fire	Kenwood	TK5210	Mobile	6
	Kenwood	TK5210K7	Portable	22
Poth Fire	GE	MVS	Mobile	3
	Midland	UNKNOWN	Mobile	1
	Motorola	RADIUS CP200	Portable	3
	Ericson	PANTHER 500P	Portable	2
	ICOM	ICF50V	Portable	2
Sutherland Springs Fire	Kenwood	TM271A	Mobile	7
	Relm	RPV599A+	Portable	4
	HYT	TC270(2)	Portable	5
Kicaster Fire	Kenwood		Mobile	1
	Vertex	3692	Mobile	1
	Vertex	VX3200V	Mobile	1
	Vertex	VX180V	Portable	8
	Kenwood	TK260G	Portable	6

Owner Agency	Subscriber Manufacturer	Subscriber Model	Portable, Mobile or Control Station?	Quantity
Three Oaks Fire	Unknown	Unknown	Portable	20 (estimate)
	Unknown	Unknown	Mobile	5 (estimate)
Eagle Creek VES	Motorola	CDM1550	Mobile	5
	Kenwood	TK272G	Portable	4
	Relm	RPV599A+	Portable	5
La Vernia EMS	Relm	RV50	Mobile	3
	Relm	RPV599A+	Portable	9
	Motorola	MAX TRACK 300	Mobile	3
Wilson County VAA	Kenwood	TK260G	Portable	3
	Kenwood	TK272G	Portable	5
	Kenwood	TK5210	Portable	1
La Vernia PD	Motorola	XTL5000	Mobile	4
	Motorola	XTS5000	Portable	6
	Motorola	XTS3000	Portable	5
Poth PD	Motorola	XTL1500	Mobile	2
	Motorola	RADIUS M1225	Mobile	1
	Kenwood	Digital P25	Portable	16
Floresville PD	Motorola	Digital Spectra	Mobile	1
	Motorola	T73X7A7TA7BK	Mobile	1
	Motorola	CM300	Mobile	1
	Kenwood	Digital P25	Mobile	10
	Motorola	ASTRO	Mobile	22
Wilson County SO	Kenwood	5710K	Mobile	6
	Motorola	STX3000	Portable	22
	Kenwood	TK5210K7	Portable	8
	Motorola	HT750	Portable	8
Wilson County OEM	ICOM	CSF50V	Portable	12
	Motorola	HT1250	Portable	2
Total Mobiles				224
Total Portables				115
Total Control Stations				0
Total				339

5.12.1.6 FCC Licenses

Table 230 – Wilson County FCC Licenses

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
KVF685	1	Wilson County		154.8300 154.9500 153.8825 155.6625	MO		100	100	20K0F3E 11K2F3E 11K2F2E 8K30F1E

Call Sign	Location	Latitude (N)/ Area of Operation	Longitude (W)	Frequencies (MHz)	Station Class	Antenna Height (m)	Output Power (W)	ERP (W)	Emission
									7K60FXE
	2	6.1 m rule		154.8300 153.8825	FX1		25 20	25 40	20K0F3E 11K2F3E 11K2F2E 8K30F1E 7K60FXE
	4	29-9-45.9	98-7-26	155.6625 155.5500	FB2	67	125	250	20K0F3E 11K2F3E 11K2F2E 8K30F1E 7K60FXE
	5	29-18-32.9	98-7-44	155.5500	FB2	53	100	360	20K0F3E 11K2F3E 11K2F2E 8K30F1E 7K60FXE
	1	29-7-49.9	98-8-55	155.9250	FB	91	25	50	20K0F3E
	2				MO		25		20K0F3E
WXQ358									

KVF685—Call sign KVF685 is licensed by the Wilson County Sheriff's Office and covers the operation of repeaters in the Floresville and La Vernia areas. Two repeaters are located at the Floresville site and one repeater is located at the La Vernia site. The repeater frequency at the La Vernia site is duplicated at the Floresville site. The emission designators 7K60FXE and 8K30F1E reflect MOTOTRBO and NEXEDGE operation. P25 operation is not covered under these emissions. P25 emissions include 8K10F1D and 8K10F1E.

WXQ358—Call sign WXQ358 is licensed by the city of Floresville and covers simplex operation for the Floresville FD. The license reflects wideband analog operation and must be updated with narrowband emissions prior to January 1, 2013. The mobile service area for the license does not include any area of operation.

5.12.1.7 System Coverage

User reported coverage is as follows:

Table 231 – Wilson County User Reported Coverage

Radio System Coverage	
Mobile coverage	Analog 90%—Digital 90%
Portable coverage	Analog 70%—Digital 75%
In-building coverage	Analog 25%—Digital 50%

The following coverage map depicts the predicted “talk out” portable coverage for the Wilson County radio system. White indicates satisfactory predicted coverage, orange indicates marginal predicted coverage, and gray indicates limited predicted coverage. The coverage map does not reflect improved “talk back” from voted satellite receivers.

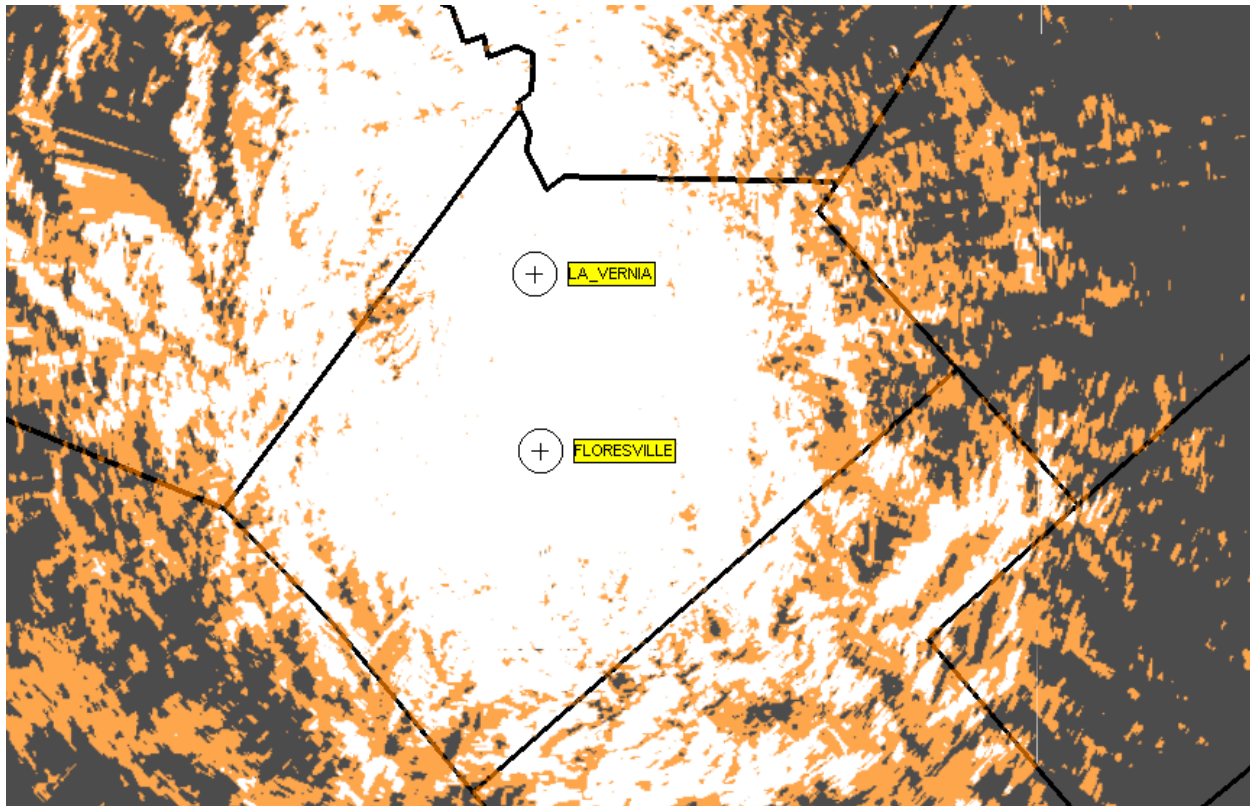


Figure 81 – Predicted Radio Coverage for Wilson County

5.12.1.8 Future Plans

Wilson County has plans to install a P25 repeater in Precinct #1.

5.12.1.9 Past Expenditures

Wilson County provided the following past radio expenditures:

Table 232 – Wilson County Past Radio Expenditures

Year	Project Description	Total Cost	Funding Source
2007	Voting Receivers	\$65,000	Assistance to Firefighters Grant
2008	Repeaters at Poth and Stockdale Water Towers	\$25,000	HSGP

Year	Project Description	Total Cost	Funding Source
2008	EOC Radio Tower	\$22,000	HSGP
2008	2 - Satellite Radio/Phone	\$18,250	HSGP
2008	HAM Radio Equipment	\$2,100	HSGP
2009	ICOM Radio Cache	\$9,000	HSGP
2009	Mobile Repeater	\$1,850	HSGP
Total		\$143,200	

5.12.1.10 Future Funding

Wilson County did not identify future funding opportunities.

5.12.1.11 Assessment

Coverage—Coverage is the most essential feature of any radio system. User feedback indicated that the present radio system provides approximately 70-75 percent outdoor portable coverage. While this level of coverage may be adequate for some rural agencies, typical coverage requirements for a countywide system are above 95 percent portable coverage. A first responder is at a great risk any time response outside of radio coverage is necessary. For fire/EMS, indoor coverage is especially critical. While simplex frequencies can be used to coordinate an event on-scene, while outside of the system coverage area, radio coverage is necessary for calls for backup and to coordinate with other users. For a county the size of Wilson, one transmitter location is insufficient to meet coverage needs for public safety users. The problem is alleviated to extent through the use of a voted receiver. The voting system, however, only serves to alleviate “talk back” coverage and increase the area that remote users can contact dispatchers. The voted receiver system does not enhance “talk out” coverage or coverage from the dispatcher or other users to remote users in the field.

Capacity—L.R. Kimball concurs that capacity on a radio system to accommodate multiple incidents is a must. Utilizing a single channel at each radio site for all public safety disciplines creates the potential for ineffective communications when multiple events occur. In addition, a single channel is virtually impossible to manage capacity during a large-scale interoperability event. The Wilson County radio system currently has two repeater channels providing service for all public safety disciplines. These two channels are shared by 14 different law enforcement, fire, and EMS entities. Even when radio user counts within each agency are low, higher agency numbers contribute to increased radio traffic. The County estimates that a minimum of two additional channels are needed to supplement system capacity.

Interoperability—Interoperability today is achieved through the use of shared VHF channels. Primary dispatch frequencies for the surrounding VHF jurisdictions are programmed into fire/EMS radios. When an interoperability response is made, the responding user will switch to the frequency of whichever agency they are assisting. This method of interoperability is effective when capacity on the systems is not an issue and the users are on the same frequency band. In the event of a major multi-jurisdictional disaster, it is likely that these conditions will not hold true. The Wilson County CENTRACOM Gold Elite dispatch console will support both a high number of channels and patching capabilities. However, only the two primary channels are integrated on the console. No Texas or national interoperability channels are integrated on the console, and thus cannot be patched to the primary channels.

6. ANALYSIS

6.1 Coverage

Proper coverage is the most important feature of any radio system. Coverage concerns are the most frequent complaint about an existing radio systems, particularly about the VHF primary systems located throughout the rural counties within the AACOG region. Radio coverage is a difficult variable to quantify. Once a radio wave leaves an antenna, the propagating wave interacts with the air, atmosphere, clouds, trees, ground, and any other medium between the transmitter and receiver. These obstacles obscure and weaken the signal, introducing additional noise.

In addition, the longer a radio wave travels, the weaker it gets. Once the wave reaches the antenna at the receiver, the radio must be able to interpret the signal, which has been weakened and corrupted with noise. The ability of a receiver to decode a signal is dependent on the signal to noise ratio, or how much signal is left relative to the noise that has been introduced. The receiver equipment itself generates noise, which the signal must overcome.

When quantifying coverage in a land mobile radio system, there are three coverage levels that must be considered:

- Mobile
- Outdoor portable
- Indoor portable

Mobile coverage is defined as the area where a vehicular-mounted radio can communicate with a transceiver on an associated radio tower. Mobile radios are higher power than portable radios, have higher mounted antennas, have more efficient antennas and have antennas mounted free from immediate obstructions. For this reason, mobile radios are able to receive a signal while introducing less noise than portable radios. This enables a mobile radio to interpret a weaker signal that a portable radio could not interpret, thus creating a wider coverage area. The higher power transmitter helps to improve “talk back” coverage or coverage from the mobile unit to the tower.

Portable outdoor coverage is more limited than mobile coverage. When using a portable radio, the signal is weakened by the user’s body. The closer an obstacle is to the antenna, the more dramatic the radio impedance. Portable radios are typically used at a lower transmitter height than mobile radios, leaving the radios more submerged in the terrain, which further impedes the signal. Transmitters on portable radios are typically limited to 3 to 5 watts, compared to mobile radios which are typically 35 to 50 watts. On average, a portable radio needs approximately four times the received signal power compared to a mobile radio to interpret the signal.

Indoor coverage is the most limited radio coverage level. Public safety radio users often have the need to communicate within buildings. Buildings further impede the radio wave, making it more difficult for the radio to interpret the signal. Building factors such as type of construction, number of floors, number of windows, location of building relative to tower sites, placement of fire walls, location of electrical wiring, and the location of the user within the building all impact the radio wave and the ability of the radio to interpret a received signal. When designing a radio system, buildings are typically quantified as to how much they degrade a radio signal. Since there are so many factors associated with in-building coverage losses, there is no perfect way to quantify building radio coverage. Losses may differ dramatically from one location to another. Radio systems are designed to meet an average

building loss specification because of significant coverage loss. Coverage within individual buildings may be enhanced through bi-directional amplifiers (BDAs), which re-radiate received signals from the roof inside of the building. Typical buildings losses range from 8 to 24 dB, or three to eight times power reduction of the signal.

When designing a radio system, coverage requirements should meet the coverage needs of the users. A state highway patrol agency may only have a requirement for mobile radio coverage, while a FD in a major metropolitan area will likely have a requirement for in-building coverage, as well as mobile and outdoor portable coverage. The higher coverage requirement a system has the more radio sites are necessary. The number of radio sites increases exponentially as the coverage requirement increases, dramatically increasing costs. When a vendor is contracted to install a radio system, a coverage requirement is typically set in the contract. Typical coverage requirements are 95 percent outdoor portable coverage throughout the entire jurisdiction; however, required coverage levels vary from system to system. Once the system is installed, the vendor must demonstrate proof of performance by testing the system using a combination of automated and manual coverage testing tools.

6.1.1 Coverage within AACOG

Coverage was reported to be a problem by most radio systems within AACOG; however, coverage on the COSA/Bexar County and LCRA systems was not reported to be a major problem. To verify coverage problems, L.R. Kimball performed radio wave propagation studies. The following table lists those agencies that indicated concerns with system coverage and agencies that L.R. Kimball determined, through propagation analysis, to have coverage gaps.

Table 233 – AACOG Coverage Gap User Agencies

Radio System	Coverage Problem	Coverage Gaps	Radio Sites in System	Sites Needed
Atascosa County	Yes	Paging coverage for VFDs in rural portions of the county	2 (close proximity)	3
Bandera County	Yes	Portable coverage limited throughout much of the county	6 (not evenly distributed)	5
San Antonio	No			
Bexar County	Yes	Limited portable coverage in northern portions of the county	12	15
Bexar County Fire Alarm	Yes	Coverage limited throughout northern portion of county and from unit-to-unit due to simplex operation	1	4
Live Oak	Yes	Coverage limited east of Shertz	1	2
Comal County Law Enforcement	No			
Comal County Fire/EMS	Yes	Portable coverage gaps throughout eastern portions of county	4 (not ideally located)	3
New Braunfels	No			

Radio System	Coverage Problem	Coverage Gaps	Radio Sites in System	Sites Needed
Frio County	Yes	Limited mobile and portable coverage	1 (site operating at reduced efficiency)	1
Gillespie County Fire/EMS	Yes	Limited mobile and portable coverage around county borders	3	5
Gillespie County Law Enforcement	No			
Guadalupe County	Yes	Portable coverage gaps in portions of county	2	4
Seguin	No			
Cibolo	No			
Karnes County	Yes	Portable coverage limited in portions of the county	2	3
Kendall County Fire/EMS	Yes	Portable coverage limited in portions of the county	1	3
Kendall County Law Enforcement	No			
Kerr County SO	Yes	Portable coverage limited in portions of the county	4	5
Kerr County Fire	Yes	Portable coverage limited throughout much of county	2	4
Kerrville PD	No			
Kerrville FD	Yes	Portable coverage limited throughout portions of the county	3	4
Medina County	Yes	Portable coverage limited throughout much of county	1	4
Wilson County	Yes	Portable coverage limited throughout portions of county	1 (digital) 4 (analog)	3

Coverage prediction maps have been provided, in the respective county sections of the document, for all systems surveyed within AACOG. Studies reflect the coverage modeling criteria outlined in TSB-88. Coverage studies demonstrate “talk-out” coverage from the tower to the radio users. VHF conventional systems have been modeled using the narrowband analog modulation. Variations of approximately 3 dB may exist between systems using wideband analog or conventional P25 systems. Parameters utilized for propagation studies have been acquired from the FCC licenses of each agency. If the information reflected on the FCC licenses is inaccurate, then the associated propagation studies will reflect these inaccuracies.

Coverage prediction maps indicate that the system users should experience a delivered audio quality (DAQ) of 3.4 or better in the areas with no color shading and a DAQ of 2 to 3.4 in the areas with the orange shading. Definitions of DAQ are as follows:

Table 234 – DAQ Performance Descriptions

DAQ	Performance Description
1	Unusable; speech present but unreadable
2	Understandable with considerable effort Frequent repetition needed due to noise or distortion
3	Speech understandable with slight effort Occasional repetition needed due to noise or distortion
3.4	Speech understandable with repetition only rarely required Some noise or distortion
4	Speech easily understood Occasional noise or distortion
4.5	Speech easily understood Infrequent noise or distortion
5	Speech easily understood

6.2 Capacity

The capacity of a radio system is the system's ability to accommodate radio traffic. When a system reaches capacity, the ability of radio users to communicate is inhibited. On a conventional system, an agency may not be able to coordinate an event because the channel is occupied by another agency or event. On a trunking system, a talk group may be denied service because all frequencies have been allocated to active talk groups. Capacity on a system is directly related to the number of radio channels in the system. A conventional type system assigns one user group for each frequency. A trunking system dynamically allocates frequencies to a pool of many user groups as needed.

Capacity on a radio system can be quantified on several levels. The lowest capacity level pertains to how the system accommodates day-to-day radio traffic. Day-to-day traffic coincides with the number of emergencies, which are typically higher during nights and weekends. Conventional systems may experience capacity problems when multiple incidents occur simultaneously for users on a shared channel. While these incidents do not necessarily occur on a day-to-day basis, they are common enough that systems should be designed to accommodate the traffic.

The next capacity level, includes planned events, such as parades and sporting events, in which increased radio traffic will be planned. During these events, it is expected that radio usage will be higher. Planned events with high radio usage can be accounted for with proper planning. Radio channels can be properly assigned ahead of time so that users can properly manage the capacity on the radio system.

The highest capacity level includes unplanned events, such as natural disasters or terrorist attacks, which demand a high level of radio resources. During these events, it is likely that a radio system must accommodate both the

primary users and incoming traffic arriving from other jurisdictions to support the event. System capacity in these events is the hardest to manage.

Like coverage, it is important to design a radio system with capacity to meet the needs of the users. The FCC guidelines recommend one radio channel for every 70 to 100 users. This is a rough estimate because actual usage is dependent on each individual agency. A more accurate estimate of loading is based on Erlang³ calculations, which take into consideration the type of users, the frequency of radio calls and the duration of radio calls. Typically, coverage is designed to meet the capacity needs during the worst case situation, not everyday use.

Trunking systems provide far more capabilities than conventional systems for managing system capacity. First and foremost, trunking systems are inherently more spectrally efficient than conventional systems since the dynamic allocations of talk groups provide a higher rate of channel reuse. Second, priority can be set on trunking systems so that access is denied to less critical user groups when capacity is reached. Third, features such as dynamic allocation enable radio managers to remotely alter user groups and their access to the radio system.

6.2.1 Capacity of AACOG Radio Systems

The following table reflects the agencies that indicated a capacity problem, and the number of additional channels estimated to meet capacity requirements.

Table 235 – AACOG Capacity Concern User Agencies

Agency	Capacity Problem	Explanation	Number of channels in system	Number of channels necessary
Atascosa County	No			
Bandera County	No			
San Antonio	No			
Bexar County	No			
Bexar County Fire Alarm	Yes	All VFDs share a total of two simplex channels	2	8
Live Oak	No			
Comal County Law Enforcement	No			
Comal County Fire/EMS	Yes	Limited to peak usage times	1	2
New Braunfels	No			
Frio County	No			
Gillespie County	No			

³ Erlang loading is the industry standard for calculating loading requirements on a trunking system

Agency	Capacity Problem	Explanation	Number of channels in system	Number of channels necessary
Fire/EMS				
Gillespie County Law Enforcement	No			
Guadalupe County	Yes	Limited to peak usage times	2	4
Seguin	No			
Cibolo	No			
Karnes County	Yes	Regular capacity problems	2	5
Kendall County Fire/EMS	Yes	Limited to peak usage times	1	6
Kendall County Law Enforcement	No			
Kerr County SO	No			
Kerr County Fire	Yes	Limited to peak usage times	2	4
Kerrville PD	No			
Kerrville FD	No			
Medina County	Yes		6	10
Wilson County	Yes	Regular capacity problems	2	4

6.3 Interoperability Issues and Standards

One of the goals of any communications systems is to provide interoperability for emergency response personnel. Specifically, interoperability has been identified as a major limitation within the radio systems in Texas and is the underlying purpose of the RICP process and this assessment. L.R. Kimball's assessment of interoperable communications in the AACOG region is based on the Interoperability Continuum developed by the Federal SAFECOM program and adopted by the Department of Homeland Security (DHS) as the standard for evaluating interoperable communications. The Interoperability Continuum provides a basis for planning both tactical interoperable communications programs and strategic initiatives to improve interoperable communications. Federal grant programs that provide funding for interoperable communications initiatives are using the goals and standards encompassed in the Interoperability Continuum.

The following information provides a foundation for L.R. Kimball's approach to assessing interoperable communications.

6.3.1 DHS Guidance and Template

The tragic events of September 11, 2001 clarified the critical importance of effective emergency responder communication systems. The lack of emergency response interoperability is a long-standing, complex and costly problem with many impediments to overcome. Interoperability is the ability of emergency response agencies to talk to one another via radio communication systems—to exchange voice and/or data with one another on demand, in real-time, when needed and when authorized.

SAFECOM is a federal program that provides research, development, testing and evaluation, guidance, tools and templates on communications-related issues to local, tribal, state and federal emergency response agencies working to improve emergency response through more effective and efficient interoperable wireless communications. SAFECOM has developed an interoperability model consisting of an Interoperability Continuum that sets goals in five elements considered essential to achieving effective interoperable communications—governance, SOPs, technology, training and exercises and usage. The goals in this continuum have been incorporated into guidelines and requirements for federal funding designated for interoperable communications. The information in this sub-section provides a brief overview of the SAFECOM interoperability model.

In general, interoperability refers to the ability of emergency responders to work seamlessly with other systems or products without any special effort. Wireless communications interoperability specifically refers to the ability of emergency response officials to share information via voice and data signal on demand, in real time, when needed, and as authorized. For example, when communications systems are interoperable, police and firefighters responding to a routine incident can talk to each other to coordinate efforts. Communications interoperability makes it possible for emergency response agencies responding to catastrophic accidents or disasters to work effectively together. Finally, interoperability allows emergency response personnel to maximize resources in planning for major predictable events, such as a Mum Fest, or for disaster relief and recovery efforts.

Tactical interoperable communications is defined as the rapid provision of on-scene, incident-based mission critical voice communications among all first-responder agencies (EMS, fire and law enforcement), as appropriate for the incident, and in support of an incident command system (ICS), as defined in the National Incident Management System (NIMS).

There are a variety of challenges to interoperability: some technical, some financial, and some stem from human factors, such as inadequate planning and lack of awareness of the real importance of interoperability.

6.3.2 Interoperability Continuum

Interoperability planning should be based on the principles developed by the SAFECOM program, including the Interoperability Continuum for achieving effective communications interoperability.



Interoperability Continuum

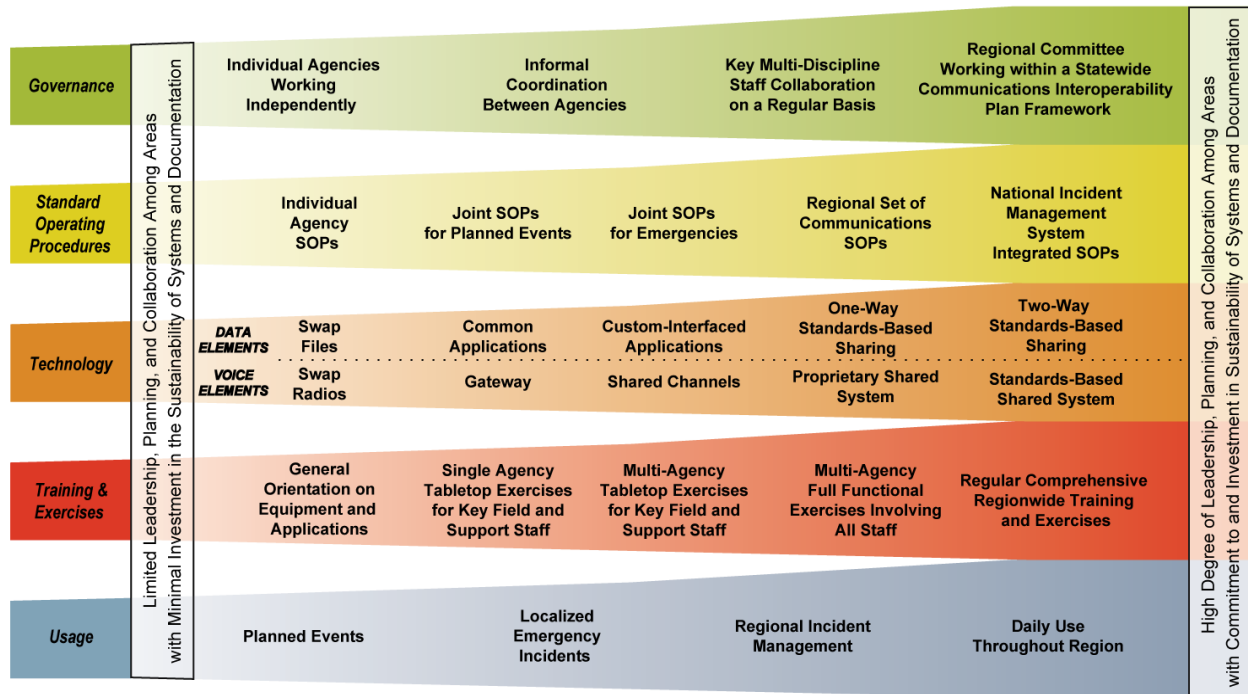


Figure 82 – SAFECOM Interoperability Continuum

The Interoperability Continuum above is designed to help the emergency response community and local, tribal, state and federal policy makers address critical elements for success as they plan and implement interoperability solutions. These elements include governance, SOPs, technology, training and exercises and usage of interoperable communications. The Interoperability Continuum was established to depict the core facets of interoperability, according to the stated needs and challenges of the emergency response community, and will aid emergency responders and policy makers in their short- and long-term interoperability efforts. Communications interoperability refers to the ability of emergency response agencies talking across disciplines and jurisdictions via radio communications systems, exchanging voice and/or data with one another on demand, in real-time, when needed, and as authorized.

Making progress in all aspects of interoperability is essential, since the elements are interdependent. Therefore, to gain a true picture of a region's interoperability, progress along all five elements of the Interoperability Continuum must be considered together. For example, when a region procures new equipment, that region should plan training and conduct exercises to make the best use of that equipment.

6.3.2.1 Leadership, Planning and Collaboration

In addition to progression along the five elements of the Interoperability Continuum, regions should focus on planning, education and outreach to maintain an awareness of the specific issues and barriers that affect a particular area's movement towards increased interoperability. For example, many regions face difficulties related to political issues and relationships within and across jurisdictions and disciplines (e.g., EMS, fire and law enforcement). Strong leadership can help to work through these challenging internal and jurisdictional conflicts, as well as set the stage for a region's commitment to the interoperability effort. Additionally, leaders must be willing to commit the time and resources necessary to assure the success of any interoperability effort. For example, ongoing maintenance and support of the system must be planned for and incorporated into the budget.

6.3.2.2 Sustainability

Communications interoperability is an ongoing process, not a one-time investment. Once a governing body is set up, it must be prepared to meet on a regular basis, drawing on operational and technical expertise to plan and budget for continual updates to systems, procedures, and training and exercise programs. If regions expect emergency responders to utilize interoperable equipment on a daily basis, supporting documentation and the installed technology must be well-maintained with a long-term commitment to upgrades and eventual replacement of equipment. Lastly, an interoperability program should include both short- and long-term solutions. Early successes can help motivate regions to tackle more time-consuming and difficult challenges. It is critical, however, that short-term solutions do not inappropriately drive the planning process, but function in support of longer-term improvements.

To drive progress along the five elements of the Interoperability Continuum and improve interoperability, emergency responders should observe the following principles:

- Gain leadership commitment from all disciplines (EMS, fire and law enforcement)
- Foster collaboration across disciplines (EMS, fire and law enforcement) through leadership support
- Interface with policy makers to gain leadership commitment and resource support
- Use interoperability solutions on a regular basis
- Plan and budget for ongoing updates to systems, procedures and documentation
- Assure collaboration and coordination across all five elements (governance, SOPs, technology, training and exercises and usage)

6.3.2.3 Governance

A common governing structure for solving interoperability issues will improve the policies, processes and procedures of any major project by enhancing communication, coordination, cooperation, establishing guidelines and principles and reducing any internal jurisdictional conflicts. This group should consist of local, state and federal entities, as well as representatives from all pertinent emergency response disciplines within the identified region. A formal governance structure is critical to the success of interoperability planning. The Interoperability Continuum identifies four levels of governance from least effective to most effective:

- *Individual agencies working independently*—A lack of coordination among responding organizations

- *Informal coordination between agencies*—Loose line level or agency agreements that provide minimal incident interoperability
- *Key multidiscipline staff collaboration on a regular basis*—A number of agencies and disciplines working together in a local area to promote interoperability
- *Regional committee working with a statewide interoperability committee*—Multi-disciplinary agencies working together across a region pursuant to formal written agreements as defined within the larger scope of a state plan; such an arrangement promotes optimal interoperability

6.3.2.4 SOPs

SOPs are formal written guidelines or instructions for incident response. They typically have both operational and technical components. The five levels of the Interoperability Continuum from least to most effective pertaining to SOPs follow:

- *Individual agency SOPs*—Uncoordinated procedures across agencies can hinder effective multi-discipline/multi-agency response.
- *Joint SOPs for planned events*—Development of SOPs for planned events. This typically represents the first phase as agencies begin to work together to develop interoperability.
- *Joint SOPs for emergencies*—SOPs for emergency-level response that are developed as agencies continue to promote interoperability.
- *Regional set of communications SOPs*—Region-wide communications SOPs for multi-agency/multi-discipline/multi-hazard responses are an integral step towards optimal interoperability.
- *NIMS integrated SOPs*—Regional SOPs molded to conform to the elements of NIMS.

6.3.2.5 Technology

Although technology is a critical tool for improving interoperability, it is not the sole driver of an optimal solution. Success in each of the other elements is essential to its proper use and implementation and should drive technology procurement. Technology is highly dependent upon existing infrastructure within a region. Multiple technology solutions may be required to support large events. The five types of technology identified on the Continuum are:

- *Swap radios*—Swapping radios or maintaining a cache of standby radios is an age-old solution that is time-consuming, management-intensive, and may only provide limited results due to channel availability.
- *Gateways*—Gateways retransmit across multiple frequency bands providing an interim interoperability solution as agencies move toward shared systems. Gateways, however, are inefficient in that they require twice as much spectrum because each participating agency must use at least one channel in each band per common talk path and because they are tailored for communications within the geographic coverage area common to all participating systems.
- *Shared channels*—Interoperability is promoted when agencies share a common frequency band, air interface (analog or digital) and are able to agree on common channels. However, the general frequency congestion that exists across the United States can place severe restrictions on the number of independent interoperability talk paths available in some bands.
- *Proprietary shared systems and standards-based shared systems*—Regional shared systems provide the optimal solution to interoperability. While proprietary systems limit the user's choice of product with regard to manufacturer and competitive procurement, standards-based shared systems promote

competitive procurement and a wide selection of products to meet specific user needs. With proper planning of the talk group architecture, interoperability is provided as a by-product of system design, thus creating an optimal technology solution.

6.3.2.6 Training and Exercises

Proper training and regular exercises are critical to the implementation and maintenance of a successful interoperability solution. The Interoperability Continuum identifies five levels of achievement in conducting training and exercises.

- *General orientation on equipment*—Agencies provide initial orientation to their users with regard to their particular equipment. Multi-jurisdictional/multi-agency operations are often an afterthought to this training, if provided at all.
- *Single agency tabletop for key field and support staff*—Structured tabletop exercises promote planning and identify response gaps. However, single agency activities do not promote interoperability across disciplines and jurisdictions. Additionally, management and supervisory training is critical to promoting routine use of interoperability mechanisms.
- *Multi-agency tabletop for key field and support staff*—As agencies and disciplines begin working together to develop exercises and provide field training, workable interoperability solutions emerge.
- *Multi-agency full functional exercises involving all staff*—Once multi-agency/multi-discipline plans are developed and practiced at the management and supervisory level, it becomes critical that all staff who would eventually be involved in actual implementation receive training and participate in exercises.
- *Regular comprehensive regional training and exercises*—Optimal interoperability involves equipment familiarization and an introduction to regional/state interoperability at time of hire (or in an academy setting). Success will be assured by regular, comprehensive and realistic exercises that address potential problems in the region and involve the participation of all personnel.

Despite the best planning and technology preparations, there is always the risk of the unexpected, critical and unprecedented incidents that require an expert at the helm who can immediately adapt to the situation. Within ICS, these specialists are called Communications Unit Leader (COMLs).

The role of the COML is a critical function that requires adequate training and cannot be delegated to an individual simply because that person “knows about radios.” Rather, the proper training of these individuals is of significant importance to a region's ability to respond to unexpected events, prepare them to manage the communications component of larger interoperability incidents and apply the available technical solutions to the specific operational environment of the event.

6.3.2.7 Usage

Usage refers to how often interoperable communications technologies are used. Success in this element is contingent upon progress and interplay among the other four elements of the Interoperability Continuum. The range of usage in actual practice includes the following:

- *Planned events*—Events for which the date and time are known. Examples include athletic events and large conferences/conventions that involve multiple responding agencies.

- *Localized emergency incidents*—Emergency events that involve multiple intra-jurisdictional responding agencies. A vehicle collision on an interstate highway is an example of this type of incident.
- *Regional incident management*—Routine coordination of responses across a region that include automatic aid fire response, as well as response to natural and fabricated disasters.
- *Daily use throughout region*—Interoperability systems that are used every day for managing routine as well as emergency incidents. In this optimal solution, users are familiar with the operation of the system and routinely work in concert with one another.

6.3.3 Technology in the Interoperability Continuum

Since this assessment is primarily based on radio technology, L.R. Kimball focused on how current and future technologies might support effective interoperability for first responders within AACOG agencies. There are five general levels on the technology element of the Interoperability Continuum—radio caches, shared channels, interoperable gateways, proprietary shared systems and standards-based shared systems.

6.3.3.1 Swapping Radios (Radio Caches)

One way to provide interoperability among agencies jointly responding to an incident is to have on-scene responders from all agencies swap their incompatible radios with those from a radio cache. This allows all responders to use a common, compatible set of radios. For a radio cache to be an effective shared resource, it should have the following characteristics:

- Be fully charged and maintained, ready for deployment at all times
- Include extra charged batteries for extended deployments
- Provide personnel to transport the radios to the incident scene
- Provide technicians for on-scene support during the deployment
- Provide check-out and tracking procedures during the incident to assure the radios are properly returned to the cache following the incident

Radio caches are used sporadically throughout the AACOG region. Most agencies operate in the VHF band and share channels with adjacent jurisdictions to communicate. Agencies that have a regular out-of-band interoperability requirement make use of permanent gateways or operate multiple mobile radios. Agencies that do have a cache of radios typically use them as replacements for radios that break in the field. These caches are limited in quantity and typically include older radios that are not properly maintained. Many of these radios are not narrowbanding compliant and will no longer be usable after January 1, 2013.

The use of radio caches to achieve interoperability is not recommended. Properly maintaining a radio cache and assuring that radios are always ready to be used is maintenance intensive. Users who use cache radios may not be familiar with the equipment or the system. In addition, cache resources are limited to the number of cache radios and are not sufficient in the event of a major disaster whereby many users must operate on the neighbor's system.

While it would certainly be desirable to eliminate the need to maintain two radio platforms to provide mutual aid communications with neighboring jurisdictions, it is important to point out that interoperable gateways (see Section 6.3.3.2 Interoperable Gateways) require overlapping coverage from both systems to be effective. It is likely that when responding to the other jurisdiction to provide mutual aid that this requirement will not be met. For example,

LCRA coverage is limited within Bexar County even though a number of LCRA talk groups are patched to the COSA/Bexar County system. For this reason, cache radios can be an effective tool when other interoperability solutions are not available.

6.3.3.2 Interoperable Gateways

Gateway systems provide connections between two or more radio networks, allowing users on one network to communicate with users on other networks. For example, a group of users on an 800 MHz channel used by Agency A can be connected to a group of users on a VHF channel used by Agency B. An interconnect is created by joining two or more radio channels or voice paths with a gateway device or console patch.

Gateway systems can be configured to support any number of channels. Using gateway systems, usually through a graphical user interface, a dispatch operator can select the appropriate channels to interconnect. With many gateways, multiple interconnect sessions involving distinct groups can be established at any given time by the gateway operator. The maximum number of simultaneous interconnect sessions in progress depends on the gateway system.

Gateway systems are typically used in regions where there is overlapping coverage of participating radio communications systems. For example, two agencies responding to an incident can have channels from their respective communications networks interconnected; however, this is only useful if the coverage area of each network includes the incident location. An agency must be able to access its own communications network. Thus, the service areas for a gateway system is generally restricted to the overlapping service area of all participating agencies in any given interconnect.

Gateways are used by a number of agencies within AACOG. Within Bexar County, gateways exist to interface the COSA/Bexar County system with the Fire Alarm system, TX VHF common channels, the LCRA system and other VHF primary agencies within the county. Gateways have been used extensively as radio users have migrated on to the COSA/Bexar County and LCRA systems. Cross-band communication using gateways is accomplished on the Live Oak system so users can communicate with neighboring jurisdictions.

The WAIS has been deployed in most PSAPs throughout the region. This system includes a Raytheon ACU1000, which is a gateway device that can be used to interface multiple frequency bands. This system, however, is not operational in many PSAPs and has not been used effectively to date.

In many areas, coverage is limited to a single frequency band and gateways are not utilized at all. While most dispatch consoles support the ability to perform ad-hoc⁴ patching, use of this feature is limited in many areas.

Portable interoperable gateways are also utilized throughout the region and can be used on a tactical basis to patch together disparate systems. Such systems are operated by San Antonio, Bexar County and a number of additional agencies within AACOG. Use of these systems requires proper setup to assure frequencies are programmed in interconnected radios correctly and proper coordination to assure interoperability resources are used quickly and effectively.

⁴ On-demand patching between radio channels initiated by the dispatcher

While gateways are an effective method to establish interoperability, they are not the ideal method due to the need for overlapping coverage and the loading of channels in multiple systems. There are, however, certainly situations where patching is an effective interoperability tool. Expanded use of patching systems is recommended for AACOG agencies as part of the solution to bridge interoperability gaps.

6.3.3.3 Shared Channels

Shared channels refer to common frequencies that have been established and are programmed into radios to provide direct interoperable communications among disparate agencies. In order to use this option, all user radios must be capable of operating on the same frequency band with the same modulation scheme. Shared channels and shared systems are the only types of interoperable communications equipment that are always available since no third party intervention or overlapping system coverage is necessary.

TXLAW1 and TXLAW2 are examples of shared channels that are common in almost all VHF radios throughout AACOG. By using these channels, VHF users can communicate directly with each other without the need for an ad-hoc patch. The modulation scheme for these channels has been set at wideband analog, which is available in all VHF radios. Since there are no repeated VHF interoperability channels assigned in Texas, shared repeater frequencies are limited to the primary dispatch frequencies of VHF jurisdictions. Most VHF primary agencies have the primary dispatch channels of adjacent jurisdictions in their radios. These shared channels are the primary means of establishing mutual aid. A responding user will switch to the primary dispatch channel of the agency to which they are entering. If capacity on the primary dispatch channel becomes an issue, interoperability traffic may be off-loaded to TXLAW1 or TXLAW2.

Since most agencies within AACOG operate in the VHF band, shared channels allow for effective interoperability communications between these agencies. The most severe interoperability gaps arise between users in different frequency bands that cannot utilize shared channels. Multi-band radios are a technology that can allow users in different frequency bands to share common channels; however, this technology is very expensive and is not widely deployed.

Interoperability on shared channels becomes more limited with the introduction of different modulation schemes. As radio systems upgrade to P25 conventional or trunking, these channels can no longer be shared with adjacent jurisdictions that operate analog-only radios. Coordination is necessary between adjacent jurisdictions to assure interoperability is not lost on shared channels when one user makes a technology change. Such interoperability gaps have been noted within AACOG.

6.3.3.4 Proprietary Shared System

Proprietary shared systems refer to the use of a common technology among multiple agencies that is proprietary to a specific vendor. An example is the COSA/Bexar County 800 MHz EDACS system. Other proprietary systems include Motorola SMARTNET, Motorola SMARTZONE, Harris OpenSky, Motorola TRBO and Kenwood NEXEDGE. Multiple users operating with this shared technology have the ability, with proper permission, to access the talk groups and features of the system. Seamless interoperability would be available provided that all users were using the same proprietary technology in the same frequency band. This would be accomplished in much the same way

that the various user groups on the COSA/Bexar County system can communicate internally within their agencies, yet switch to shared talk groups to communicate with other agencies.

Proprietary systems have the inherent limitation of being specific to an individual vendor. Use of proprietary systems as a regional interoperability solution requires the consensus of all stakeholders on the vendor and technology to implement. Regional proprietary systems limit the capabilities of users from outside the region to communicate. Individual agencies that choose to operate proprietary solutions without the consensus of interoperability partners create an interoperability scenario that is limited to a gateway solution.

In the present public safety radio market, proprietary systems are not recommended as an interoperability solution. Proprietary systems became popular during the advent of trunking systems in the 1980s and 1990s. With the development of P25, proprietary systems are less desirable for the inherent interoperability limitations and vendor restrictions.

6.3.3.5 Standards-based Shared System

Standards-based shared systems involve the implementation of a common standards-based technology. Examples of standards-based technologies include P25 and TETRA, although TETRA is not utilized within the United States. By implementing standards-based shared systems, radio users have the flexibility to purchase equipment from different vendors and still maintain shared communications on trunking architecture. This allows users from different agencies to access shared talk groups on neighboring systems in much the same way that shared channels are used. However, shared systems accessed in this case provide the guest user access to wide area coverage, security and other feature sets provided by trunking systems. Trunking systems are better able to manage system loading and capacity and are thus better able to accommodate an influx of interoperability traffic. Since the system is standards-based, it is more likely that users responding from outside the region will have radios with a common standards-based technology that will operate on the system.

The only interoperability limitation with standards-based shared systems is the frequency band. When users operate in disparate frequency bands, the only solutions available to allow cross-band communication are gateways or multi-band radios.

6.3.3.6 System-of-systems Design

Information provided by TXDPS and the SCIP alludes to a “system-of-systems design” for each COG throughout the state of Texas. A system-of-systems design refers to a single regional system serving as the interoperability backbone to connect local systems. Such a system provides a coverage footprint in a single frequency band throughout the entire region, allowing for the effective use of patching with local jurisdictions. The regional system would have a common set of SOPs for usage that would be common to every interconnecting agency. By connecting to the regional system, a local user would then have access to all other users and radio resources on the regional system. A system of this nature eliminates the need for every system operator to develop a set of interoperability SOPs with every other user. In addition, users do not need to address interoperability gaps with multiple technologies and frequency bands. All users are interconnected as long as they establish a connection with the regional system.

To align with the Interoperability Continuum, a regional system implemented in a system-of-systems design is recommended to be a P25 system, satisfying the standards-based shared system criteria. The State's vision is for each COG to implement a system-of-systems that would enable adjacent COGs to interconnect the regional systems with ISSI, which allows user roaming from system to system while maintaining communications with the home system. Such a design would allow a seamless connect for users anywhere within the state of Texas and the network of interconnected P25 systems.

While there are clear benefits of a system-of-systems design, implementation of such a system requires overcoming challenges. First and foremost, funding must be acquired to build out a radio system that will not be used for day-to-day traffic. When funding is limited, it is difficult to justify this expense. It is also difficult to determine which project stakeholders are responsible for contributing to the system, what agency(s) will own the system once it is built, what agencies will be responsible for maintaining the system and what requirements will be for new users on the system. Overcoming these obstacles is critical for implementing a shared system of any magnitude.

L.R. Kimball agrees with the State's vision of a system-of-systems approach and believes that a regional system is an ideal solution for AACOG. Such a system would enable the local jurisdictions to have flexibility in their primary system selections, while establishing an interoperability backbone to bridge the interoperability gaps experienced today.

6.3.4 Texas Statewide Interoperability Channel Plan

The Texas SICP (TSICP) is a document developed by the Texas Statewide Interoperability Executive Committee (TSIEC) that outlines the interoperability channels in the VHF, UHF, 700 MHz and 800 MHz bands. The plan also defines how the channels should be programmed, used, licensed and on what technologies the channels should be implemented.

The plan provides a great deal of information regarding use of the interoperability channels, and L.R. Kimball recommends that all agencies review the plan. Several key takeaways from the plan include:

Beginning January 1, 2015 all communications using interoperability channels in Texas must utilize compliant P25 Phase I CAI (Common Air Interface) digital modulation. This requires that all deployed subscriber equipment be capable of operating in the P25 conventional mode. Primary communications systems do not have a P25 requirement associated with this plan.

Texas common channels in the VHF band (TXLAW1, TXLAW2, TXFIRE1, etc) will operate in wideband analog mode until January 1, 2013 when the narrowbanding mandate goes into effect.

Following the implementation of narrowbanding, the interoperability channels will be replaced with narrowband channels on different frequencies. These frequencies may operate in the analog narrowband mode until December 31, 2014.

On January 1, 2015, the new narrowband VHF interoperability channels will be converted to P25 digital modulation.

Interoperability calling channels are used for communication between interoperability responders and dispatchers. Interoperability calling channels include TXLAW2, VCALL10, UCALL40, 7CALL50 and 8CALL90. At a mutually agreed upon point within region, operations on the VHF calling channel should be converted from TXLAW2 to VCALL10. This transition should coincide with the completion of narrowbanding among all interoperability agencies.

Operation of radio equipment, including subscribers and temporary base stations, is permitted with an FCC license as long as the public safety agencies sign a memorandum of understanding (MOU) with TXDPS. Operation of fixed base stations requires a separate FCC license for the public safety agency.

The following table outlines the use of the VHF wideband interoperability channels. This table is only **valid until January 1, 2013.**

Table 236 – VHF Wideband Interoperability Channels

Channel	Description
TXLAW1	Primary on-incident calling and coordination channel for mobile and portable units. Note that mobile and portable units in the field will hear nearby transmissions directed to dispatch centers on Texas Law 2 but will not hear dispatch center responses.
TXLAW2	Primary transient/en-route calling channel for interoperable VHF wideband channel communications between mobile/portable units and fixed or temporary dispatch, incident base, and repeater stations. Note: the Texas Law 2 channel is no longer designated as an "Intercity" channel.
TXLAW3	Tactical frequency primarily for law enforcement-related incidents/events, but can be used as determined by the incident commander for any discipline.
TXFIRE1/2/3	Tactical channels primarily for fire agencies, but can be used as determined by the incident commander for any discipline. Texas Fire 1 is widely used as a Command channel on wild fire incidents.
TXMED1	Tactical channel primarily for medical agencies, but can be used as determined by the incident commander for any discipline. Texas Med 1 is recommended for landing zone communications with EMS helicopters.
TXAIR2	Ground-to-Air communications with State and Federal Aircraft ONLY that may be assigned to an incident or event. It is to be used with only state and federal aircraft and is not designated for use with local aircraft, including local EMS aircraft. Other frequencies associated with the VHF wideband frequencies can be used with local EMS aircraft, such as Texas Med 1.

The following tables define the interoperability channels, frequencies, and Private Line/Network Access Code (PL/NAC) tones/codes to be used for interoperability channels in the VHF, UHF, 700 MHz and 800 MHz frequency bands.

Table 237 – VHF Interoperability Channel Mobile and Portable Configuration

Label	Receive	Transmit	Station Class	CTCSS TX/RX Thru 12/31/2014	P25 NAC Hex/Dec Required 1/1/2015	Use
VCALL10	155.7525	155.7525	FB/MO	156.7	\$293 / 659	Calling Channel
VTAC11	151.1375	151.1375	FB/MO	156.7	\$293 / 659	Tactical Channel
VTAC12	154.4525	154.4525	FB/MO	156.7	\$293 / 659	Tactical

Label	Receive	Transmit	Station Class	CTCSS TX/RX Thru 12/31/2014	P25 NAC Hex/Dec Required 1/1/2015	Use
						Channel
VTAC13	158.7375	158.7375	FB/MO	156.7	\$293 / 659	Tactical Channel
VTAC14	159.4725	159.4725	FB/MO	156.7	\$293 / 659	Tactical Channel
VFIRE21	154.2800	154.2800	FB/MO	156.7	\$293 / 659	Tactical Channel
VFIRE22	154.2650	154.2650	FB/MO	156.7	\$293 / 659	Tactical Channel
VFIRE23	154.2950	154.2950	FB/MO	156.7	\$293 / 659	Tactical Channel
VFIRE24	154.2725	154.2725	FB/MO	156.7	\$293 / 659	Tactical Channel
VFIRE25	154.2875	154.2875	FB/MO	156.7	\$293 / 659	Tactical Channel
VFIRE26	154.3025	154.3025	FB/MO	156.7	\$293 / 659	Tactical Channel
VMED28	155.3400	155.3400	FB/MO	156.7	\$293 / 659	Tactical Channel (for ground to air use)
VMED29	155.3475	155.3475	FB/MO	156.7	\$293 / 659	Tactical Channel
VLAW31	155.4750	155.4750	FB/MO	156.7	\$293 / 659	Tactical Channel
VLAW32	155.4825	155.4825	FB/MO	156.7	\$293 / 659	Tactical Channel

Table 238 – UHF Interoperability Channel Mobile and Portable Configuration

Label	Receive	Transmit	Station Class	CTCSS TX/RX Thru 12/31/2014	P25 NAC Hex/Dec Required 1/1/2015	Use
UCALL40	453.2125	458.2125	FB2/MO	156.7	\$293/659	Calling Channel (Repeater)
UCALL40D	453.2125	453.2125	FB/MO	156.7	\$293/659	Calling Channel (Direct)
UTAC41	453.4625	458.4625	FB2/MO	156.7	\$293/659	Tactical Repeater Channel
UTAC41D	453.4625	453.4625	FB/MO	156.7	\$293/659	Tactical Repeater (Direct)
UTAC42	453.7125	458.7125	FB2/MO	156.7	\$293/659	Tactical Repeater Channel
UTAC42D	453.7125	453.7125	FB/MO	156.7	\$293/659	Tactical Repeater

Label	Receive	Transmit	Station Class	CTCSS TX/RX Thru 12/31/2014	P25 NAC Hex/Dec Required 1/1/2015	Use
						(Direct)
UTAC43	453.8625	458.8625	FB2/MO	156.7	\$293/659	Tactical Repeater Channel
UTAC43D	453.8625	453.8625	FB/MO	156.7	\$293/659	Tactical Repeater (Direct)

Table 239 – 700 MHz Interoperability Channel Mobile and Portable Configuration

Label	Receive	Transmit	Station Class	P25 NAC Hex/Dec	Use
7CALL50	769.24375	799.24375	FB2/MO	\$293/659	Calling Channel
7CALL50D	769.24375	769.24375	FB/MO	\$293/659	Calling Channel (Direct)
7TAC51	769.14375	799.14375	FB2/MO	\$293/659	Tactical Repeater Channel
7TAC51D	769.14375	769.14375	FB/MO	\$293/659	Tactical Channel (Direct)
7TAC52	769.64375	799.64375	FB2/MO	\$293/659	Tactical Repeater Channel
7TAC52D	769.64375	769.64375	FB/MO	\$293/659	Tactical Channel (Direct)
7TAC53	770.14375	800.14375	FB2/MO	\$293/659	Tactical Repeater Channel
7TAC53D	770.14375	770.14375	FB/MO	\$293/659	Tactical Channel (Direct)
7TAC54	770.64375	800.64375	FB2/MO	\$293/659	Tactical Repeater Channel
7TAC54D	770.64375	770.64375	FB/MO	\$293/659	Tactical Channel (Direct)
7TAC55	769.74375	799.74375	FB2/MO	\$293/659	Tactical Repeater Channel
7TAC55D	769.74375	769.74375	FB/MO	\$293/659	Tactical Channel (Direct)
7TAC56	770.24375	800.24375	FB2/MO	\$293/659	Tactical Repeater Channel
7TAC56D	770.24375	770.24375	FB/MO	\$293/659	Tactical Channel (Direct)
7GTAC57	770.99375	800.99375	FB2/MO	\$293/659	Tactical Repeater Channel
7GTAC57D	770.99375	770.99375	FB/MO	\$293/659	Tactical Channel (Direct)
7MOB59	770.89375	800.89375	FB2/MO	\$293/659	Tactical Repeater Channel
7MOB59D	770.89375	770.89375	FB/MO	\$293/659	Tactical Channel (Direct)
7LAW61	770.39375	800.39375	FB2/MO	\$293/659	Tactical Repeater Channel
7LAW61D	770.39375	770.39375	FB/MO	\$293/659	Tactical Channel (Direct)
7LAW62	770.49375	800.49375	FB2/MO	\$293/659	Tactical Repeater Channel
7LAW62D	770.49375	770.49375	FB/MO	\$293/659	Tactical Channel (Direct)
7FIRE63	769.89375	799.89375	FB2/MO	\$293/659	Tactical Repeater Channel
7FIRE63D	769.89375	769.89375	FB/MO	\$293/659	Tactical Channel (Direct)
7FIRE64	769.99375	799.99375	FB2/MO	\$293/659	Tactical Repeater Channel
7FIRE64D	769.99375	769.99375	FB/MO	\$293/659	Tactical Channel (Direct)
7MED65	769.39375	799.39375	FB2/MO	\$293/659	Tactical Repeater Channel

Label	Receive	Transmit	Station Class	P25 NAC Hex/Dec	Use
7MED65D	769.39375	769.39375	FB/MO	\$293/659	Tactical Channel (Direct)
7MED66	769.49375	799.49375	FB2/MO	\$293/659	Tactical Repeater Channel
7MED66D	769.49375	769.49375	FB/MO	\$293/659	Tactical Channel (Direct)
7DATA69	770.74375	800.74375	FB2/MO	\$293/659	Tactical Repeater Channel
7DATA69D	770.74375	770.74375	FB/MO	\$293/659	Tactical Channel (Direct)
7TAC71	773.10625	803.10625	FB2/MO	\$293/659	Tactical Repeater Channel
7TAC71D	773.10625	773.10625	FB/MO	\$293/659	Tactical Channel (Direct)
7TAC72	773.60625	803.60625	FB2/MO	\$293/659	Tactical Repeater Channel
7TAC72D	773.60625	773.60625	FB/MO	\$293/659	Tactical Channel (Direct)
7TAC73	774.10625	804.10625	FB2/MO	\$293/659	Tactical Repeater Channel
7TAC73D	774.10625	774.10625	FB/MO	\$293/659	Tactical Channel (Direct)
7TAC74	774.60625	804.60625	FB2/MO	\$293/659	Tactical Repeater Channel
7TAC74D	774.60625	774.60625	FB/MO	\$293/659	Tactical Channel (Direct)
7TAC75	773.75625	803.75625	FB2/MO	\$293/659	Tactical Repeater Channel
7TAC75D	773.75625	773.75625	FB/MO	\$293/659	Tactical Channel (Direct)
7TAC76	774.25625	804.25625	FB2/MO	\$293/659	Tactical Repeater Channel
7TAC76D	774.25625	774.25625	FB/MO	\$293/659	Tactical Channel (Direct)
7GTAC77	774.85625	804.85625	FB2/MO	\$293/659	Tactical Repeater Channel
7GTAC77D	774.85625	774.85625	FB/MO	\$293/659	Tactical Channel (Direct)
7MOB79	774.50625	804.50625	FB2/MO	\$293/659	Tactical Repeater Channel
7MOB79D	774.50625	774.50625	FB/MO	\$293/659	Tactical Channel (Direct)
7LAW81	774.00625	804.00625	FB2/MO	\$293/659	Tactical Repeater Channel
7LAW81D	774.00625	774.00625	FB/MO	\$293/659	Tactical Channel (Direct)
7LAW82	774.35625	804.35625	FB2/MO	\$293/659	Tactical Repeater Channel
7LAW82D	774.35625	774.35625	FB/MO	\$293/659	Tactical Channel (Direct)
7FIRE83	773.50625	803.50625	FB2/MO	\$293/659	Tactical Repeater Channel
7FIRE83D	773.50625	773.50625	FB/MO	\$293/659	Tactical Channel (Direct)
7FIRE84	773.85625	803.85625	FB2/MO	\$293/659	Tactical Repeater Channel
7FIRE84D	773.85625	773.85625	FB/MO	\$293/659	Tactical Channel (Direct)
7MED86	773.00625	803.00625	FB2/MO	\$293/659	Tactical Repeater Channel
7MED86D	773.00625	773.00625	FB/MO	\$293/659	Tactical Channel (Direct)
7MED87	773.35625	803.35625	FB2/MO	\$293/659	Tactical Repeater Channel
7MED87D	773.35625	773.35625	FB/MO	\$293/659	Tactical Channel (Direct)
7DATA89	774.75625	804.75625	FB2/MO	\$293/659	Tactical Repeater Channel
7DATA89D	774.75625	774.75625	FB/MO	\$293/659	Tactical Channel (Direct)

6.3.5 Statewide Communications Interoperability Plan

The TSCIP is a document that was developed with the goal to “Optimally position Texas to prevent acts of terrorism, protect critical infrastructures and key resources, and respond to and recover from all disasters.”⁵ The plan provides a high-level summary of interoperability within the state, outlines desired interoperability goals corresponding to each tier on the interoperability continuum and outlines statewide strategic initiatives to achieve those goals.

Based upon the goals and strategic initiatives outlined in the plan, there are several key takeaways that are relevant to public safety agencies:

The plan outlines the vision to provide the highest level of interoperability available to all levels of government by 2015. The highest level identified on the Interoperability Continuum is standards-based shared systems. The plan identifies the P25 suite of standards as the technology solution and long-term interoperability goal for public safety voice communications. L.R. Kimball notes that this statement does not require public safety agencies to implement P25 systems by 2015, but rather identifies it as a vision.

Standards-based shared systems are the technology of choice, and new digital voice systems should be compliant with P25. This recommendation does not preclude funding for non-P25 compliant equipment; however, the purchase of non-P25 compliant equipment must be presented with compelling reasons for using other solutions. The first priority for federal funding is to “provide basic, operable communications within a department with safety as the overriding consideration.” Funding requests for non-P25 systems must be presented with an explanation of how the radio selection will allow for improving interoperability or eventual migration to interoperable systems.

The identified mission is to achieve maximum interoperability levels on the Interoperability Continuum. For each level, specific tasks have been identified. These include:

- Building a governance structure of regional committees working with a statewide interoperability committee
- Hiring a full-time SCIP Interoperability Coordinator and support staff
- Finalizing the Texas SCIP Governance Charter based on the SAFECOM/DHS template. Tasks: research, evaluate, draft, confirm
- Conducting annual focus group sessions and annual statewide strategic planning conference
- Promoting state legislation that enforces timely and cost-efficient execution of strategic plan initiatives
- Assisting regions with governance development for regional shared interoperable communications systems. Task: request ICTAP assistance.
- Developing project accountability policies and procedures to assure successful implementation and that “taxpayer’s get maximum value for their dollars.” Tasks:
 - Develop and require project management and cost analysis reports
 - Provide project management training
 - Update vendors on accountability measures
- Developing SOPs where NIMS is integrated into the SOPs
- Developing, by region, a communications SOP for response to emergencies. Tasks:

⁵ From the State Communications Interoperability Plan.

- Develop a template for the common regional integrated state and local agency communications SOP
- Regions adopt common integrated SOP by 3/15/2010
- Review and post SOPs by 6/2010
- Evaluating and coordinating mutual aid interoperability channels in the 800 MHz and VHF bands.
- Funding infrastructure improvements for implementation of all recognized mutual aid channels (800 MHz, 700 MHz, VHF, and UHF)
- Promoting a communications interoperability plan/agreement with Mexico
- Expanding and/or implementing technology for regional shared systems
- Providing operability throughout the state by implementing solutions to close gaps found through user surveys and communication asset survey and mapping (CASM) data analysis. GAP Analysis Tasks:
 - Identify gaps
 - Implement solutions.
- Assisting regions in the development of plans to migrate radio assets to a standards-based, shared system-of-systems (Regional Migration Plans)
- Developing a plan for operability and interoperable communications along the Texas-Mexico border from El Paso to Brownsville (Mexico Border Communications)
- Developing a process to address frequency coordination, radio interference, and conflict mediation (Frequency coordination)
- Requiring training and exercises that are regular, comprehensive and regional
- Enhancing training and exercise programs (COML Training)
- Developing and exercising CCG emergency disaster communications capabilities (Communications Coordination Group [CCG])
- Encouraging daily use of interoperable communications systems throughout the regions
- Developing and keeping current an interactive statewide communications assessment database (Communications Assets)
- Implementing programs to require routine use of interoperability equipment (Usage Drill)
- Providing National Emergency Communications Plan (NECP) Goal 1: 90 percent of urban areas security initiative (UASI) areas are able to demonstrate response-level emergency communications within one hour for routine events involving multiple jurisdictions and agencies
- Providing NECP Goal 2: 75 percent of non-UASI jurisdictions are able to demonstrate response-level emergency communications within one hour for routine events involving multiple jurisdictions and agencies
- Providing NECP Goal 3: 75 percent of all jurisdictions are able to demonstrate response-level emergency communications within three hours in the event of a significant incident
- Funding initiatives
- Securing consistent funding for ongoing development, capital replacement, and maintenance costs (Operation Texas Talks)
- Prioritizing funding for immediate and critical communications needs

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6.3.6 Regional Interoperability Communications Plans

The RICP is the underlying purpose behind this study. The RICP is designed to align with the SCIP at the local level, outlining actual plans to meet the strategic initiatives defined in the SCIP. The RICP is intended to be completed at a COG level. Some of the specific goals of the RICP include:

- Defining existing radio systems and operations within the region
- Defining a governance structure to oversee projects defined in the RICP
- Summarizing plans to build out radio systems that bridge interoperability goals and align with the strategic initiatives defined in the SCIP
- Presenting a migration plan to build out the planned systems
- Summarizing the timeline and costs for all project implementations
- Defining Regional SOPs, including use of interoperability channels and interoperability assets
- Defining the ICS and personnel who can fill specific ICS roles

Addressing these items, the RICP addresses the following initiatives defined in the SCIP:

- Develop, by region, a communications SOP for response to emergencies. Tasks:
 - Develop a template for the common regional integrated state and local agency communications SOP
 - Adopt, by region, common integrated SOP by 3/15/2010
 - Review and post SOPs by 6/2010
 - Evaluate and coordinate mutual aid interoperability channels in the 800 MHz and VHF bands.
 - Fund infrastructure improvements for implementation of all recognized mutual aid channels (800 MHz, 700 MHz, VHF, and UHF)
 - Provide operability throughout the state by implementing solutions to close gaps found through user surveys and CASM data analysis (GAP Analysis). Tasks:
 - Identify gaps
 - Implement solutions
 - Assist regions in the development of plans to migrate radio assets to a standards-based, shared system-of-systems (Regional Migration Plans)
 - Develop and keep current an interactive statewide communications assessment database (Communications Assets)
 - Provide NECP Goal 1: 90 percent of UASI areas are able to demonstrate response-level emergency communications within one hour for routine events involving multiple jurisdictions and agencies
 - Provide NECP Goal 2: 75 percent of non-UASI jurisdictions are able to demonstrate response-level emergency communications within one hour for routine events involving multiple jurisdictions and agencies
 - Provide NECP Goal 3: 75 percent of all jurisdictions are able to demonstrate response-level emergency communications within three hours in the event of a significant incident
 - Secure consistent funding for ongoing development, capital replacement, and maintenance costs (Operation Texas Talks)
 - Prioritize funding for immediate and critical communications needs

6.4 Emerging Communications Issues and Trends

6.4.1 APCO Project 25 Standards

The Association of Public Safety Communications Officials (APCO) P25 standards are standards for public safety digital radio that have been established under the guidance of APCO and moved under the Telecommunications Industry Association (TIA). P25 involved representatives from local, state and federal government agencies who evaluate basic technologies in advanced LMR. P25 is an industry-wide effort to set the recommended voluntary standards of uniform digital two-way radio technology for public safety organizations.

P25 is a suite of eight standards intended to help produce equipment that is interoperable and compatible regardless of manufacturer. The P25 suite of standards involves digital LMR services and includes the following standard interfaces:

- Common air interface (CAI)
- Fixed/base station subsystem interface (FSSI)
- Inter radio frequency subsystem interface (ISSI)
- Console subsystem interface (CSSI)
- Data network interface
- Network management interface
- Telephone interconnect interface
- Subscriber data peripheral interface

P25 has four key objectives:

- Provide enhanced functionality with equipment and capabilities focused on public safety needs
- Improve spectrum efficiency
- Assure competition among multiple vendors through open systems architecture
- Allow effective, efficient, and reliable intra-agency and inter-agency communications

P25 is intended to make informed decisions easier for users when planning to convert existing system to digital. Using the P25 standards, each vendor's system should begin on a level playing field determined by an agreed upon baseline set of specifications. This allows users to more accurately compare the direct features and benefits of both entire systems and individual radio products. It is intended to make bidding processes more competitive among prospective vendors. In addition, users should have the opportunity to mix and match equipment among P25 compliant suppliers since their equipment will follow all basic standards.

DHS in its 2007 Federal Grant Guidance for Emergency Response Communications and Interoperability Grants indicated a strong preference for P25 compliant radio equipment, stating:

When procuring equipment for communication system development and expansion, a standards-based approach should be used to begin migration to multi-jurisdictional and multi-disciplinary interoperability. Specifically, all new digital voice systems should be compliant with the P25 suite of standards. This recommendation is intended for government-owned or -leased digital land

mobile public safety radio equipment. Its purpose is to make sure that such equipment or systems are capable of interoperating with other digital emergency response land mobile equipment or systems. It is not intended to apply to commercial services that offer other types of interoperability solutions. Further, it does not exclude any application if the application demonstrates that the system or equipment being proposed will lead to enhanced interoperability. With input from the user community, these standards have been developed to allow for backward compatibility with existing digital and analog systems and to provide for interoperability in future systems. The FCC has chosen the P25 suite of standards for voice and low-to-moderate speed data interoperability in the new nationwide 700 MHz frequency band and the integrated wireless network (IWN) of the United States Homeland Security, Justice and Treasury Departments has chosen the P25 suite of standards for their new radio equipment. The United States Department of Defense has also endorsed P25 for new LMR systems.⁶

Only where there are compelling reasons to do so will the federal government fund the procurement of non-P25 compliant radio equipment.

The final documents establishing the P25 standard were approved and signed in August 1995 at the APCO International Conference and Exposition in Detroit, Michigan. These are referred to as the P25 Phase I standards; however, P25 is an ongoing project. The current effort, referred to as P25 Phase II, is to develop standards for narrowband spacing using 6.25 kHz channel spacing. This will require the use of TDMA technology. In April 2007, the majority of the P25 steering committee selected what is referred to as the 12-kilobit per second, two-slot TDMA solution for Phase II technology.

According to the committee, this selection not only will allow for graceful migration and compatibility with Phase I systems, but advances capabilities into an even more robust P25 system. This solution was chosen in order to accommodate ever-increasing needs for efficiency and capacity in public safety wireless voice and data radio systems, while ensuring full-feature functionality and improved audio quality. The P25 Phase II standard is currently under development and is anticipated to be approved during the fourth quarter of 2010. Equipment is being sold today that will support P25 Phase II via a software upgrade. Motorola and Harris are predicting that fully compliant P25 Phase II systems and software will be available during 2011.

6.4.2 Multi-band Radios

Multi-band radios are an emerging technology that allows a single subscriber unit (mobile or portable) to communicate in multiple frequency bands. Examples of P25 Phase II compliant multi-band radios on the market today are the Motorola APX radios, the Harris Unity radio and the Thales Liberty radio. Dual-band radios are not presently represented on the interoperability continuum, but represent a powerful tool for establishing interoperability between systems operating in different frequency bands.

⁶ Recommended Federal Grant Guidance Emergency Response Communications and Interoperability Grants Fiscal Year (FY) 2007, Department of Homeland Security, SAFECOM, 2007, pp. 13-14.
http://www.safecomprogram.gov/NR/ronlyres/8FE2AC9D-6E05-4713-8928-876284384E4E/0/FY07SAFECOMGrantGuidance_FINAL4_.pdf

Dual-band radios are recommended as an effective means of establishing interoperability without the need for overlapping coverage areas or gateways. Minimal training is needed for users operating dual-band radios as system switches may be accomplished simply by changing the channel on the radio. Cross-band scanning allows users to monitor dispatch channels from multiple overlapping systems on different frequency bands.

Multi-band radios are costly. The average cost of on-the-market multi-band radios is \$7,000, which is likely more than the cost of two individual radios operating in two different frequency bands. In addition, these radios are still limited in their ability to communicate on proprietary systems. Proprietary systems such as Motorola SMARTNET, Harris EDACS and Harris OpenSky are still limited to radios developed or licensed by that manufacturer. As multi-band radios are on the market longer and competitors introduce additional multi-band radios, the cost can be expected to decrease.

6.5 FCC Narrowband Mandate

6.5.1 Narrowband Mandate Impact on Existing Two-way Radio and Paging Equipment

The FCC has mandated that licensees using VHF high band and UHF equipment move to narrowband technology utilizing a bandwidth of only 12.5 kHz (kilohertz) per voice channel by January 1, 2013. Licensees must either use a technology that provides one voice channel per 12.5 kHz or one that operates at a data rate of 4800 bps per 6.25 kHz of bandwidth. In order to bring about a timely transition to narrowband technology, the FCC set forth the following Order:

Set January 1, 2013, as the deadline for industrial/business and public safety radio pool licensees in the 150-174 MHz and 421-512 MHz bands to either migrate to 12.5 kHz technology or utilize a technology that achieves equivalent efficiency;

Prohibited any applications for new systems using 25 kHz channels, or modification applications that expand the authorized contour of an existing 25 kHz station, effective January 1, 2011 ⁷

The purpose of this requirement is to allow the use of new narrowband frequencies that have been inserted between existing VHF high band and UHF frequencies. Although these new narrowband frequencies are currently available for licensing and use by emergency services, their use is limited by potential interference from adjacent wideband frequencies. Once all existing users re-tune their radios for narrowband operation, the available frequencies in VHF High band and UHF will dramatically increase.

Many LMR system users have expressed concern over a loss of range when migrating from wideband 25 kHz emission to 12.5 kHz emission narrowband operation. This is a very real concern for operators of narrowband systems. The reduced range, which is observed when moving from wideband to narrowband, is a function of altered signal to noise ratio in an analog-type frequency modulation (FM) system, which reduces DAQ for the same radio signal level.

⁷ *Third Report and Order*, WT Docket No. 99-87, RM-9332, 22 FCC Rcd 6083, 6088 ¶ 10 (2007)

6.5.2 Problems Encountered when Mixing Wideband and Narrowband Channels

The move to narrowband channel spacing is not simply a matter of reprogramming narrowband capable radios. Mixing wideband and narrowband radios in a system may result in serious communications problems. Attempting to transmit from a narrowband channel to a wideband channel may result in the received audio being very soft and quiet or the audio signal may not be processed by the wideband receiver. Turning up the volume may be a temporary solution to mitigate the problem. Attempting to transmit from a wideband channel to a narrowband channel may result in the received audio being loud, distorted or inaudible. These symptoms are inconsistent and variable in how they present themselves. One transmission may be unreadable, but the next is clear. Excessive background noise or increased voice level may exacerbate the problem. One person's transmissions may be better than another person's due to voice characteristics. When transmitting on a wideband channel through a narrowband repeater, the audio may cut out. Turning down the volume on the receive radio may help, but may result in narrowband transmissions not being heard. Speaking quietly and not directly into the microphone of the narrowband radio may also mitigate the problem.

Clearly, mixing wideband and narrowband on the same radio channel is a recommended mode for public safety communications. For this reason, moving an agency's radio system to narrowband operation must be coordinated both internally and externally to assure that communications capabilities are not disrupted.

6.5.3 Impact of Narrowbanding on AACOG Agencies

Since most agencies operate in the VHF band, narrowbanding has played a considerable role in radio system purchases over the last several years and will continue to play a major role in radio system progression over the next two years.

A considerable effort has already been made to replace older wideband-only equipment with narrowband capable radios. Narrowband replacements have primarily been P25-grade public safety radios. Some agencies have tackled the narrowbanding problem by upgrading their systems to P25 conventional systems. Other agencies have addressed the problem by purchasing business-grade subscriber equipment. While these radios are not designed to the durability and reliability requirements that public safety-grade radios are, they satisfy the narrowbanding requirement.

There are still a number of agencies within the AACOG region who have not fully upgraded their subscriber equipment to narrowband capabilities. These agencies predominantly include the VFDs.

While most subscriber equipment within the region is narrowband capable, base stations are still widely programmed in the narrowband mode. All subscriber radios and base stations must be reprogrammed to operate in the narrowband mode in order to comply with the FCC mandate. It is essential that all users on a given system are operating narrowband radios before the base station is reprogrammed. To avoid mismatched wideband to narrowband communications during the cutover, channels can be programmed in subscriber radios in both the wideband and narrowband modes. When the base station is reprogrammed, the user simply begins using the narrowband channel.

Coordination between adjacent jurisdictions is very important when narrowbanding a system. When a system is converted to narrowband operation, agencies who may respond in a mutual aid event must be made aware of the

change. If a system is upgrading to P25 digital, then analog-only subscribers will not be able to communicate. To properly manage narrowbanding cutovers, it is essential that agencies communicate when their cutovers will take place so that neighboring jurisdictions can plan accordingly. L.R. Kimball documented several cases where cutovers were made without coordination. Since communication between wideband and narrowband systems is still possible, diagnosing the problem can be difficult.

6.5.4 Modification of FCC Licenses for Narrowband Operation

FCC licenses must authorize the licensee to use the narrowband emissions. The typical narrowband emissions designator is 11K2F3E, although 11K0F3E is also common. The FCC will verify narrowbanding compliance by checking to see whether narrowbanding emissions have been added to each FCC license. Narrowbanding emissions may be added to existing wideband emissions; it does not have to be one or the other. It is generally good practice to update FCC licenses before the system is narrowbanded. This is a good opportunity for licensees to update their FCC licenses to reflect changes, such as additional mobile radios, contact persons and addresses, as well as technical changes or modifications.

6.6 Major Issues Facing the Communications Systems

6.6.1 System Life Cycle Considerations

Two-way radio equipment has always had a replacement life cycle. The life cycles of today's robust feature-rich radio systems have been particularly impacted by rapidly advancing and changing technologies.

Based on the typical lifespan of each type of equipment, a general schedule of replacement is shown in the table below. Replacement cycles may vary (+/- 25 percent) based on factors such as the need for new technology and general wear and tear. Once equipment reaches the end of its lifespan, it is time to start upgrades of that equipment.

Table 240 – Facility Equipment Lifespan

Facility Equipment	Lifespan
Building: Prefabricated	15 Years
Building Block	20 Years
Towers	20 Years
Generators: Small/Remote Sites	10 Years
Generators: Large/Main Sites	15 Years
Grounding Systems	10 Years

Table 241 – Maintenance Equipment Lifespan

Maintenance Equipment	Lifespan
Fencing	10 Years
HVAC: Small/Remote Sites	2-5 Years
HVAC: Large/Main Sites	10 Years

Table 242 – Telephone Equipment Lifespan

Telephone Equipment	Lifespan
PBX	7 Years
9-1-1 Switch	7 Years
Desktop Instruments	7 Years

Table 243 – Radio Equipment Lifespan

Radio Equipment	Lifespan
Repeaters/Base Stations	15 Years
Antenna Systems	7 Years
Dispatch Consoles	10 Years
Mobile Radios	10 Years
Portable Radios	7 Years
Pager Units	5 Years

Table 244 – Microwave Equipment Lifespan

Microwave Equipment	Lifespan
Radios	10 Years
Channel Banks	10 Years
Battery Systems	10 Years
UPS: Small Battery Systems	2-3 Years

6.6.2 AACOG Equipment Life Cycle

The life cycle of radio equipment brings up several key points within AACOG. First, there is a great deal of radio equipment in place that is past its life expectancy. Some equipment was noted that dates back to the 1970s. Once radio equipment passes its typical life cycle, the equipment becomes more prone to failure and is harder to repair or replace. Replacement parts are only maintained by manufacturers for a set period of time after the equipment is discontinued. Once equipment has reached a certain age, replacement parts may be difficult, if not impossible to find. Virtually all subscriber equipment manufactured within the last 13 years is narrowband capable. Any wideband-only radios are likely older than 13 years and due for replacement.

Another consideration of system life cycles is that radio equipment reaches its end-of-life at different rates. At any one given time, there are likely components of a radio system that are due for replacement. This enforces the fact that radio system purchases are a year-to-year expense. In much of AACOG, agencies indicated no radio budget, outside of grant funding when it is available. Proper maintenance of a radio system requires yearly maintenance, upgrades, and replacements to ensure equipment is operating effectively and reliably.

6.7 Frequency Bands

When building out a radio system, selection of a frequency band will dramatically impact the cost and complexity of the radio system.

Two frequency bands are presently used within the region – 800 MHz and VHF. Since radio waves at different frequencies interact with the environment differently and are licensed differently, there are a number of pros and cons for each band. VHF is a more favorable frequency band for outdoor coverage because signals propagate farther. 800 MHz is more favorable for building penetration and for trunking systems since channels are pre-paired and are better organized to limit co-channel and adjacent-channel interference. VHF frequencies are very difficult to license due to the long-time use of the frequency band, lack of rules protecting service areas and lack of pre-paired TX/RX channel pairs. The FCC recently implemented protection criteria to allow for trunking in the VHF band; however, these criteria make it incredibly difficult to license new VHF systems with enough channels to support trunking. The “reframing” of the VHF band associated with narrowbanding has opened a great deal of new VHF frequencies between original wideband allocations; however, licensing these frequencies is still difficult as adjacent wideband channels must be protected. VHF channels are not pre-paired for repeater operations, and thus, two frequencies must be licensed for each channel pair.

The 800 MHz frequency band was established in the late 1980s and was established with criteria protecting existing users and pre-paired channels for repeater operations. Recent givebacks from Sprint/Nextel, resulting from the rebanding of the 800 MHz frequency band, have resulted in 800 MHz spectrum becoming available for public safety licensees in much of the United States. All current production 800 MHz public safety radios are capable of operating in the 700 MHz band. The 700 MHz band includes bountiful spectrum that can be used to build out trunking systems. The propagation characteristics of 700 MHz are similar to that of 800 MHz.

The availability of frequencies for licensing is heavily dependent on the frequency use within the area. A frequency may only be licensed if sufficient separation exists between transmitters and receivers of users operating on the same frequency. Both VHF and 800 MHz are heavily utilized in the AACOG area, making the acquisition of additional channels in either band extremely difficult.

Trunked radio systems require “clean” frequencies to function, meaning they are free of co-channel and adjacent-channel interference. Trunked frequencies cannot be shared with other users as typically done with conventional VHF and UHF frequencies. When using VHF and UHF frequencies in a conventional system, it is possible to eliminate minor interference and avoid listening to co-channel users by using CTCSS. CTCSS cannot be used in trunking architecture.

In general, 700 or 800 MHz are more favorable for trunking systems; however, in rural areas there are clear benefits to be seen from VHF. Building out a system in VHF will typically result in a reduction of radio sites. In some cases the difficulties associated with obtaining sufficient VHF spectrum outweigh the costs associated with building out additional radio sites. If a VHF trunking system is to be built, it is essential that the user work with the equipment vendor to identify the appropriate channel spacing and pairing needed for the system to function. This includes TX to RX spacing, TX to TX spacing and RX to RX spacing between all stations licensed at any one given radio site, in addition to the use of interference-free channels. Extensive reuse of existing VHF spectrum will likely be necessary

to obtain sufficient channels for a trunking system. Simulcast trunking systems can make more efficient use of available channels by reusing the same frequency at multiple radio sites.

Alternatively, 700 MHz is the most likely source of channels to build out a large scale trunking system. 700 MHz channels have been assigned to every county within the United States. These channels can be identified in the Computer Assisted Pre-Coordination Resource and Database System⁸ (CAPRAD). For a regional system, L.R. Kimball recommends the use of 700 MHz due to frequency availability. For local systems, L.R. Kimball recommends the use of VHF or 700 MHz, depending on the coverage challenges that are unique to each agency.

6.8 Connectivity

Typically, connectivity for a public safety communications network is comprised of one or a combination of the following:

- Leased telephone lines
- Fiber optic cables
- Wireless links (e.g., microwave or radio frequency RF links)

In most situations, connectivity is a combination of analog and digital circuits that carry voice, data and control tones between the radio consoles and network of radio communication sites.

Backhaul connectivity is sparsely used within the existing radio systems in AACOG. Backhaul connectivity is needed for multi-site systems utilizing simulcast, multi-cast or voted receiver technologies. To bridge the operability and interoperability gaps addressed in this report, it is likely that multi-site wide area systems will be needed that require backhaul connectivity between radio sites.

6.8.1 Leased Telephone Lines

Leased telephone lines are the simplest form of backhaul connectivity. To interconnect two radio sites or a radio site and a PSAP, an agency may lease a T1 line from the local telephone company. A single T1 is typically capable of supporting the bandwidth requirements of a small to moderately sized trunking system. By leasing the T1 line for a monthly fee, the user has guaranteed bandwidth on the network. The specific fee depends on the length of the connection. T1 lines are subject to the reliability of the switched telephone network, which utilizes copper wires as the primary medium.

6.8.2 Fiber-optic Networks

Fiber optic cables provide the highest bandwidth and excellent radio site connectivity of any medium available today. Extensive fiber-optic networks, however, are not heavily implemented for various reasons.

- Single points of failure within a fiber network can be mitigated through the use of redundant network paths.
- Running new fiber optic cable is very expensive, and not typically justified solely for a radio project.

⁸ www.caprad.org

- Bandwidth on a fiber system can support many broadband data systems; far more than is necessary for a radio system.
- Fiber-optic networks that have been implemented are primarily found in major metropolitan areas.

6.8.3 Wireless Links

Microwave networks provide a means to wirelessly connect radio sites and dispatch facilities. Bandwidth on a microwave network is typically greater than or equal to a leased T1 line. Microwave networks are an excellent alternative when no fixed line infrastructure is present. In addition, a microwave network can be entirely owned by the agency and not require monthly fees as is necessary with leased T1 lines. Microwave networks, however, can be unreliable in various ways.

- Microwave networks are not subject to reliability concerns resulting from line breakage, but are subject to wireless phenomenon such as rain fading.
- Microwave dishes may be misaligned in high winds, potentially impacting link connectivity.
- Microwave network capacity is generally higher than the bandwidth requirements for radio systems, so other data applications can be used on the network.

6.9 System Architecture Options

6.9.1 Single Site Conventional

Single site conventional systems are the most basic of public safety systems installed today. These systems operate as a stand-alone site, which, at a minimum, includes a repeater, duplexer, and antenna. Each repeater corresponds to one specific channel on a subscriber radio. Coverage on that channel is limited to the coverage provided by the radio site. If multiple repeaters are implemented at a single site, each repeater corresponds to a different channel. Connectivity from the tower to the dispatch center is provided via an RF control station. These stations are basically stationary mobile radios that receive the repeated audio from the radio site, and play it on the dispatch console. The other form of site connectivity is needed.

The primary limitation of a single-site conventional system is coverage, which is limited to the area around the single radio site. Often, agencies will operate multiple conventional sites to cover a larger area. With this setup, each site basically functions as its own system with its own unique coverage area. When a user roams throughout the coverage area, the user must switch to the appropriate channel associated with the tower in closest range. Radio users talking on channels on different towers will not be able to communicate directly with each other unless the dispatcher has established a patch to link the stations. Dispatchers are challenged with knowing what channels to use to contact users in the field. If coverage is provided by four different radio sites, then there are four distinct dispatch channels for each discipline that dispatchers must monitor. As the number of radio sites in a conventional system increases, the operational challenge placed on radio users and dispatchers increases dramatically.

Single sites can be implemented in wideband analog, narrowband analog and conventional P25 configurations. Wideband systems are currently being phased out in the VHF and UHF bands associated with the FCC's narrowbanding mandate. Single-site conventional systems can be implemented in the VHF, UHF, 700 MHz and 800 MHz bands; however, conventional stations are limited by the FCC to five frequencies per site. 700 MHz

systems must be digital and future regulations imposed on the 700 MHz band will prevent the operation of conventional systems unless they are used on the interoperability channels or channel efficiency can be increased.

The following list summarizes some of the strengths and weaknesses associated with single-site conventional radio systems:

- Strengths
 - Simple design, requiring minimal radio equipment to function
 - Less expensive than other system options
 - Very effective for small coverage areas that can fit within the footprint of a single site
 - Single failure will not negatively impact multiple radio sites
 - Less expensive subscriber options available
 - All radios are capable of operating in the analog conventional mode
- Weaknesses
 - Dispatchers have to monitor multiple channels and track which users are in the range of which channels
 - Responders have to switch channels depending on their geographic area
 - Users within the range of different towers cannot communicate directly with each other unless a console patch is performed
 - Towers cannot be located out-of-range from a control station located at the dispatch centers unless another form of backhaul is implemented

In general, L.R. Kimball does not recommend single-site conventional systems unless the coverage needs of a specific agency are entirely satisfied by the single site.

6.9.2 Conventional with Satellite Receivers

A conventional system with satellite receivers works much like a single-site conventional system does, but utilizes multiple receivers to enhance “talk back” coverage. In a radio system, coverage is defined for both “talk out” and “talk back”. “Talk out” coverage is coverage from the radio tower to the remote user. “Talk back” is coverage from the radio user to the radio tower. Typically, “talk out” coverage stretches further than “talk back” coverage. A user in “talk out” range, but out of “talk back” range, will hear the dispatcher and other users, but will not be able to return calls to the dispatcher or other users.

The satellite receivers are receive-only stations located at different radio sites. The “satellite” receivers are programmed to the same frequency as the primary receiver. When a remote user transmits, the signal is received by multiple receive sites in the network. Backhaul connectivity, provided typically by a microwave network or leased T1 line, sends the receive audio to a voter comparator. The device compares the multiple audio sources and selects the one that is the most clear. That audio is then passed to the transmitter to be repeated.

Satellite receivers are useful tool for enhancing “talk back” coverage; however, their use is limited because most jurisdictions that have coverage problems with a single conventional site will likely need multiple transmitters and receivers to meet coverage needs. A satellite receiver system is still limited to a single transmitter.

The costs associated with satellite receivers are much higher than single-site conventional systems because multiple base stations, multiple radio sites, backhaul and voting equipment are needed.

Single sites can be implemented in wideband analog or narrowband analog modes. Wideband systems are currently being phased out in the VHF and UHF bands associated with the FCC's narrowbanding mandate. Equipment vendors are currently developing solutions to implement satellite receiver systems using P25 conventional. Satellite receiver systems can be implemented in the VHF, UHF and 800 MHz frequency bands. 700 MHz systems must be digital, and thus prevent the use of satellite receiver systems.

- Strengths
 - Greater coverage compared to single-site conventional systems
 - Audio quality is generally improved throughout coverage area
 - Backhaul connectivity and voting equipment can be reused in future simulcast or trunking systems
 - Adequate when improved "talk back" coverage satisfies coverage need throughout jurisdiction
 - Utilizes same subscriber equipment as other conventional systems
 - When coverage goals are met, a single channel is sufficient throughout the coverage area
- Weaknesses
 - Expenses are significant compared to single-site systems
 - Application is limited to areas where additional receive sites will provide adequate coverage
 - Multiple transmitters will still require users to switch channels between transmitters, and dispatchers to monitor multiple channels
 - Not available in P25 modes
 - Limited to one user group per channel

In general, L.R. Kimball does not recommend the use of satellite receiver systems, unless the coverage provided by the satellite receivers is sufficient to meet the coverage needs of the users.

6.9.3 Conventional Simulcast

Conventional simulcast systems have very similar architectures to that of voted receiver systems. The primary difference is that all interconnected sites transmit and receive. Simulcast refers to system architectures where the same frequencies are transmitted at multiple radio sites. Configuration must be designed carefully, as radio sites on the same frequencies will interfere with each other if timing on the transmitters is not perfectly coordinated. The most ideal method of timing simulcast transmitters uses global positioning system (GPS) clocks with high accuracy oscillators. Audio received by multiple radio sites is voted to determine which audio stream has the best quality. That audio is then sent to all radio sites for retransmission.

A conventional simulcast system provides a system solution that can supply coverage from multiple radio sites over a large area. With a simulcast system, a single channel is utilized throughout the entire coverage area. Users roaming throughout the area do not need to switch channels and dispatchers only monitor a single channel per user group. Conventional simulcast systems utilize the same subscriber equipment as single-site conventional systems.

The cost associated with conventional simulcast systems is not much greater than satellite receiver systems. Most core components are the same, including backhaul connectivity, voters, and repeater stations at each radio site. The primary additions are the transmission systems at the satellite sites and simulcast equipment at each radio site. The primary limitation with conventional simulcast systems is capacity. For every user group, a repeater needs to be added at each base station. The FCC restricts the use of conventional stations to five frequencies per radio site. Once capacity needs grow beyond five channels, it is typically more beneficial to implement a trunking system. There are potential areas of interference within a simulcast system in areas where radio coverage from multiple sites overlap. It is in these areas where the potential for sites to interfere with each other can occur, if timing between them is not ideal. Simulcast systems have multiple solutions for achieving transmitter timing, some less expensive and less accurate than others. Cheaper simulcast designs are likely to experience more interference problems in overlapping coverage areas.

Conventional simulcast systems are available in the VHF, UHF and 800 MHz frequency bands.

- Strengths
 - Design can provide single-channel coverage over a wide area
 - Flexible design can be used to enhance coverage where necessary through the addition of radio sites
 - Voted audio assures best available audio is retransmitted
 - System is spectrally efficient, reusing frequencies at multiple radio sites
 - Less expensive than trunking systems
 - Backhaul and coverage design provide upgrade path to trunking system in the future
- Weaknesses
 - Capacity is limited to one user group per channel
 - Voting equipment is currently limited to analog only, so P25 conventional systems are not available in a simulcast mode
 - Potential interference exists in simulcast overlap areas
 - Loss of the backhaul connection will result in the loss of multiple radio sites

In general, L.R. Kimball recommends conventional simulcast systems when a system requires a large coverage area, but does not have high capacity needs.

6.9.4 Multi-cast Trunking

A multi-cast trunking system utilizes a trunking architecture whereby different frequencies are utilized at each radio site. In general, a trunking system has a larger pool of user groups than radio channels. When a specific user group needs to communicate, the radio system assigns the group to a specific channel. Since each user group is not talking all the time, the system is able to better manage spectral efficiency by only assigning active groups to a specific frequency. With a multi-cast trunking system, different frequencies are utilized at each radio site.

Trunking systems typically provide a multi-site wide area coverage solution. A multi-cast system allows users to roam from site to site without switching channels. While the actual radio frequencies change, the radio system is able to handshake traffic between sites and channels so that communication on a specific talk group is seamless to the user.

Trunking systems have a number of added features that are alluring to public safety users. These include encryption, system keys, system identifications (IDs), telephone interconnect, private call, group calls, dynamic talk group allocations, over-the-air rekeying, over-the-air programming, low-bandwidth mobile data and other features that are not available with conventional radio systems.

Trunking systems have a significantly larger hardware requirement than conventional systems. Above and beyond a conventional simulcast system, trunking systems require a central core to serve as the brain of the system, managing users, radio traffic, site affiliations and other aspects that are seamless to the end user. Trunking controllers are needed at radio sites to assign repeaters to specific talk groups. Trunking systems are very complex and require stringent conditions to function properly. Due to the complexity of these systems and the associated cost, a much higher value is placed on assuring site conditions are optimal and system alarming tools are utilized.

Compared to a simulcast trunking system, multi-cast systems are less spectrally efficient since different frequency groups are needed at each radio site. For high density areas, this can amount to a dramatic number of frequencies in a very small area. Multi-cast systems, however, are beneficial in the event that connectivity is lost. Should site connectivity be lost, each site will continue to operate in site trunking mode. Wide area coverage and site-to-site communication will be lost, but communications around any one given site will continue.

Subscriber equipment for trunking systems is generally more expensive than equipment for analog systems. Radios capable of both modes require an expensive firmware upgrade to perform trunking operation. Inexpensive business-model radios are not typically capable of operating on public safety grade-trunking systems.

Multi-cast trunking systems are available in the VHF, UHF, 700 MHz and 800 MHz bands, although typically these systems are implemented in 700 MHz or 800 MHz. VHF presents challenges with locating spectrum sufficient for trunking operation. Trunking systems may operate in analog or digital modes; however, today's market is primarily based on digital P25 systems.

➤ Strengths

- Wide area coverage solution that is capable of supporting relatively small systems to statewide and multi-state systems
- Scalable capacity to meet needs of many users
- System can be operated in conjunction with simulcast trunking systems and single-site conventional systems
- Communication continues in the event backhaul connectivity is lost
- Increased number of features (compared to conventional systems)
- Less expensive than simulcast trunking systems because timing circuits are not necessary

➤ Weaknesses

- Spectrally inefficient compared to simulcast systems
- Spectral inefficiency limits use for VHF systems due to channel availability
- Expensive system and subscribers compared to conventional systems

In general, L.R. Kimball recommends a multi-cast design for regional systems covering a large area or for areas where spectrum availability is not constricted.

6.9.5 Simulcast Trunking

Simulcast trunking systems operate much like multi-cast trunking systems. The primary difference is that frequencies are reused at multiple radio sites in simulcast trunking systems. Implementation of simulcast circuits requires the introduction of timing circuits as discussed in the conventional simulcast section. The feature sets provided by multi-cast trunking systems are similar to those provided by simulcast trunking systems.

With the introduction of timing circuits, the opportunity exists for interference in simulcast overlap areas. In addition, loss of backhaul connectivity can result in a catastrophic failure. Since sites operate on the same frequencies, loss of coordination between the sites limits the ability of the sites to function as independent systems without interference with each other. Typically, simulcast systems are designed to fall back to a more limited number of radio sites that do not share overlapping coverage. Due to this reason, it is especially important that backhaul networks be designed to very high fault tolerant with reliability levels when accommodating simulcast systems.

Simulcast trunking systems are available in the VHF, UHF, 700 MHz and 800 MHz bands, although typically these systems are implemented in 700 MHz or 800 MHz. VHF presents challenges with locating spectrum sufficient for trunking operation. Trunking systems may operate in analog or digital modes; however, today's market is primarily based on digital P25 systems.

- Strengths
 - Wide area coverage solution that is capable of supporting relatively small systems to statewide and multi-state systems
 - Scalable capacity to meet needs of many users
 - Can be operated in conjunction with simulcast trunking systems and single-site conventional systems
 - Additional features (compared to conventional systems)
 - Most spectrally efficient system design available
- Weaknesses
 - More expensive than multi-cast systems
 - Potential for interference in simulcast overlap areas
 - Loss of multiple sites in the event backhaul connectivity is lost
 - Expensive system and subscribers compared to conventional systems

In general, L.R. Kimball recommends simulcast trunking systems for high population areas where spectrum availability is limited.

6.10 Wide Area Interoperability System

WAIS is a Raytheon solution that has been implemented within AACOG. The system includes Raytheon/JPS ACU1000s located at most PSAPs throughout the COG. The ACU1000 gateway has been interfaced with mobile radios in the VHF, UHF, 700 MHz and 800 MHz bands. Through a console-type interface, users may manually establish patches between frequency bands on the ACU1000. The user interface is a computer screen that allows users to manually establish patches on the system. Access to the patching system is shared over the Internet, so users can establish patches at different PSAPs or remotely from a device connected to the Internet.

As it stands today, user feedback regarding the WAIS system is predominantly negative. The following are key problems noted with the WAIS system:

- The system is not operational in many PSAPs in AACOG. Equipment has either not been set up or is not configured properly. In some cases, the equipment is still in the original packaging.
- Training on the WAIS consoles has been insufficient to familiarize dispatchers with use of the system. There are no locations within AACOG that use the WAIS system on a regular basis.
- The WAIS console is a separate piece of equipment from the dispatch console. Because it is rarely used, dispatchers are not familiar with it.
- Radios on the WAIS system are currently interfaced with low profile antennas on the roofs of the dispatch centers. These antennas do not provide adequate coverage to support a patched-based system.
- Subscriber radios interfaced with the WAIS system are not P25-capable. Patching connectivity is limited to analog-only systems.

6.10.1 WAIS Recommendations

While the WAIS system has been ineffective to date, L.R. Kimball recommends the following enhancements that will enable AACOG users to receive beneficial use of the system:

- Configure the WAIS system properly in all PSAPs where it has been provided.
- Conduct training sessions on the equipment, inclusive of printed and video training documentation.
- Conduct weekly exercises using the system to build familiarity among dispatchers who would operate the WAIS console.
- Upgrade radios interfaced with the WAIS gateway with P25-capable radios that can operate in both trunking and conventional modes.
- Set up the interfaced radios in a control station configuration that will pass audio to off-site repeaters. This will enable coverage to be provided by high-profile antennas on radio towers instead of the coverage available at the dispatch center.

Regardless of the technology solutions implemented, the WAIS system can be utilized as a patching tool to bridge multiple radio systems. The WAIS system, however, will never provide a complete interoperability solution. The capabilities provided are similar to those available with a console patch. The primary difference is that the WAIS system interconnects patching capabilities between PSAPs and other computers over the Internet. The WAIS system is not a solution for coverage or capacity, nor is it a solution for an ineffective dispatch console.

L.R. Kimball recommends that the WAIS system be enhanced to provide functionality. There are benefits noted from use of the WAIS system. L.R. Kimball believes that the WAIS system will ultimately provide a part of the AACOG interoperability solution, but will not be the central component of that solution.

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7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Regional Concerns

As indicated in the baseline systems assessment, underlying interoperability gaps are present within AACOG. To summarize these gaps, the information below has been provided.

Frequency Band and Technology Diversity—Interoperability gaps within AACOG are predominantly the result of different technologies and frequency bands. The three bands predominantly used within the region (VHF, 800 MHz and 900 MHz) have minimal ways to connect with each other. Gateways are not used extensively throughout much of the region and overlapping coverage from system to system to support gateway usage is limited. VHF systems include a mix of wideband, narrowband, and P25 operation from agency to agency. Changes are made in these systems with minimal coordination to maintain interoperability with neighboring jurisdictions.

Training and Standard Operating Procedures—Interoperability training and SOPs were not indicated throughout most of AACOG. Interoperability is predominantly based on verbal agreements between agencies to share programming of primary dispatch channels. TXLAW1 and TXLAW2 are implemented extensively throughout the region, but naming conventions and usage for these channels vary from agency to agency.

System Operability—It is often stated that interoperability cannot come unless primary systems are, first and foremost, operable. There were many cases where primary systems include severe coverage and capacity gaps that limit both operability and interoperability. There are many systems that utilize a large number of conventional stand-alone sites. While managing these sites proves difficult for primary system users, managing these sites is even more difficult for incoming interoperability traffic that does not utilize the radio system on a day-to-day basis.

Interoperability Assets—Interoperability assets, including radio caches and fixed/mobile gateways, are limited in many of the rural areas of AACOG. In the event of a major disaster, these could be the only devices available to bridge communications between VHF primary users and incoming 800 MHz responders from San Antonio. For those agencies that do have interoperability assets, SOPs outlining when and how to use the equipment is limited.

800 MHz Coverage—The predominant public safety response in the AACOG region is located in San Antonio and Bexar County. These users operate on the COSA/Bexar County 800 MHz EDACS system. Today, virtually no 800 MHz footprint exists outside of Bexar County. Should an event occur in a VHF primary jurisdiction that requires response from San Antonio, primary users will have no means to communicate with incoming 800 MHz users. The only resources available include mobile gateways and the WAIS system, both of which have severe coverage limitations.

7.2 Regional Solution Options

The most challenging interoperability gap to address in the AACOG region is technology. Developing a technology solution requires a significant investment that will require the cooperation of all agencies within AACOG. Properly managing the solution will require extensive coordination, training, and SOPs to utilize any implemented solutions.

L.R. Kimball has identified the following as potential solutions for bridging interoperability gaps:

- Regional P25 system using “system-of-systems” approach
- VHF/800 MHz Hybrid P25 System
- Interoperability Repeater Gateway Network

7.2.1 Regional P25 System

A regional P25 system would require building out a P25 trunking system that would provide a coverage footprint throughout all of AACOG. Such a system would serve as the interoperability backbone interconnecting all local systems. The system would provide sufficient capacity to accommodate a large-scale interoperability event anywhere within the region. Each local system will have the primary responsibility of connecting their local system to the regional system through shared channels or gateways, depending on the local technology and frequency band used.

Building out such a system would permit local users to have the flexibility with choices regarding their primary radio systems. Users would have the opportunity to migrate primary operations entirely on to the regional system. Migrating to the system would provide users access to the most full-featured public safety radio technology available today. Since 700 MHz is the only frequency band available with sufficient spectrum to support a region-wide system, users choosing to migrate to the system will need to replace all subscriber equipment. Users who remain on their primary system could interconnect with the regional system through the WAIS system, through a console patch, the P25 system core or another gateway. At a minimum, this connection includes implementing a control station for all desired interconnected channels in the primary system. Associated interoperability channels would be established in the P25 regional system to correspond to each agency.

Such a system would align with goals outlined in the SCIP and RICP templates. The system would permit the implementation of ISSI gateways interconnecting neighboring P25 systems. With this level of connectivity, users would have the ability to communicate anywhere within the interconnected network of P25 systems. Users would have the ability to roam from system to system, provided that a base station resource exists on the same frequency band as the roaming radio, and that radios are programmed properly.

LCRA has proposed an interoperability solution to the AACOG region to build out a 700 MHz trunking overlay for public safety primary use which closely aligns with these goals. The system would utilize the existing Harris VIDA core purchased by LCRA. LCRA would manage construction of the system, which would utilize radio sites and backhaul currently used in the 900 MHz LCRA EDACS system.

The LCRA 900 MHz footprint currently covers six counties within the AACOG region. Upgrading the system would require installing 700 MHz trunking infrastructure at each of these locations. For those AACOG counties not covered by the LCRA footprint, LCRA has proposed developing new radio sites to expand the system and provide backhaul connectivity to the existing system. As proposed, the system will utilize 11 radio sites for those counties within the LCRA 900 MHz footprint. Nine additional radio sites will be developed in the five counties currently un-served by LCRA. As proposed, the system will provide between 89 and 99 percent mobile coverage within each AACOG county, and 64 to 92 percent portable coverage. No plans have been considered to expand the LCRA footprint into Bexar County as a 700 MHz overlay is already planned.

Once the system is constructed, radio users will have the opportunity to either utilize the system for primary operation or remain on their existing systems and utilize the 700 MHz system to interface with 700/800 MHz subscriber units for mutual aid purposes.

For primary operation, public safety agencies will have to purchase a subscriber fleet consisting entirely of 700 MHz radios. These users will have designated talk groups within their jurisdiction. In addition, users on the LCRA 700 MHz system will have the ability to communicate with any other users in the LCRA system through dedicated interoperability channels. Since the system will be constructed on the P25 standard, any P25 capable 700/800 MHz radio with trunking software will be able to operate on the system. All radio users will be able to access both the Bexar Metro 700 MHz system and the LCRA system. In order to make up operating costs of the system, a usage fee is required by LCRA for each radio resource on the system.

For users who remain in the VHF band, the 700 MHz overlay can be utilized to provide connectivity with incoming users from Bexar County or elsewhere within the region. For interoperability to be obtained, a gateway solution must be implemented. This can be accomplished through console patches, the WAIS system or other fixed gateway solutions. This patching capability will enable local VHF channels to interconnect with 700 MHz talk groups on the LCRA system. Patching is limited to the overlapping coverage footprints of both systems. Two desktop control stations are needed by the VHF user to provide connectivity with two talk groups on the LCRA system.

7.2.1.1 Strengths and Weaknesses

Strengths and weaknesses of the Regional P25 system include the following:

- Strengths
 - Provides capability for connectivity between all radio platforms in place today
 - Allows existing radio systems to remain relatively unchanged
 - Provides regional trunking infrastructure which may be utilized by each AACOG agency for primary operation if they decide to migrate to the system
 - Provides highest level of interoperability on Interoperability Continuum once all users adopt the standard
 - Is constructed and managed by LCRA, placing minimal system requirements on each agency
 - Utilizes existing resources to limit costs, including P25 VIDA core, radio sites, and backhaul
- Weaknesses
 - Capacity on system may not be utilized in some areas for extensive periods of time when interoperable communications are not necessary or where interoperability is achieved using shared VHF channels
 - Coverage footprint may require expansion to meet individual agency coverage requirements
 - Usage fees per radio will be required of agencies leasing capacity on the system
 - Upgrades will be needed to patch primary systems to the network
 - System will not be owned by individual public safety agencies

7.2.1.2 Preliminary Estimated Costs

The following table lists the initial costs associated with the Regional P25 system.

Table 245 – Regional P25 System Preliminary Estimated Costs

Component	Cost per Unit	Quantity	Cost
Radio Fixed Infrastructure	\$6,150,000		\$6,150,000
Project Estimated Cost			\$6,150,000

Additional estimated costs, such as monthly maintenance fees, are as follows:

Table 246 – Regional P25 System Additional Estimated Costs

Component	Cost per Unit
Radio Maintenance Fees	\$15/month \$100/month

The cost estimate listed above is based on the estimate provided by LCRA and utilizes the sites and design as proposed. The number of subscribers is an estimate and assumes that all user groups will eventually migrate to the 700 MHz system. The cost for each subscriber is an average based on the varied costs of portable and mobile units. Subscriber costs are solely based on interfacing existing systems with the LCRA P25 systems. These costs include a total of five control stations per county, plus a monthly fee of \$100/month for dispatch consoles

7.2.1.3 L.R. Kimball Recommendation

L.R. Kimball recommends the Regional P25 system, as a viable solution for AACOG. The system satisfies the interoperability requirements necessary to bridge the existing interoperability gaps and provides a framework to meet the highest level of interoperability available today as users migrate to the 700 MHz portion of the system. Users will have the ability to meet interoperability gaps utilizing their existing systems. Investments for these users will be limited to console upgrades and control stations. These users may migrate to the 700 MHz system as their needs and finances support a migration. The use of multi-band radios, while expensive today, provide an ideal migration strategy that will enable current VHF users to purchase subscriber assets that will also operate on the 700 MHz system post migration.

While the system provides limited portable coverage in some areas, mobile coverage on the system is 90 percent or higher. As an interoperability backbone, coverage requirements are not typically as high as they are for primary systems. For users migrating primary radio communications to the system, additional radio sites may be necessary.

7.2.2 Hybrid VHF/700 MHz/800 MHz P25 System

7.2.2.1 System Description

A second solution available for implementation within the AACOG region is to build out a regional VHF/700 MHz/800 MHz hybrid trunking system. The system would involve building out a VHF trunking infrastructure throughout all AACOG counties, except Bexar County, which would operate on 800 MHz. In this system, traffic

would not be able to roam between VHF systems and 700/800 MHz systems unless a multi-band subscriber is utilized. The P25 core is capable of supporting multiple frequency bands.

To implement this solution, an infrastructure overhaul would be needed over much of the region. The primary difference between this solution and the 700/800 MHz solution is that a VHF hybrid system would require fewer radio sites and would allow for some reuse of existing VHF equipment. LCRA radio sites and backhaul could be used to support VHF trunking. The Bexar Metro area would remain in the 700 and 800 MHz frequency bands and would utilize the planned 700 MHz P25 overlay. VHF users on the south side of AACOG could utilize existing radio sites, but would need to purchase P25 infrastructure and radio backhaul to link radio sites and the system core. All subscriber radios in the region would have to be upgraded or replaced to meet P25 trunking requirements.

Due to technology limitations, interoperability on such a system would be limited unless multi-band radios are used. To address interoperability gaps, a detailed gateway system will be necessary to assure that 800 MHz connectivity is available in areas primarily serviced by VHF and likewise that areas primarily serviced by 700/800 MHz have connectivity to VHF stations. This can be accomplished by placing repeaters throughout the service area programmed to the 8CALL and 8TAC frequencies in areas primarily serviced by VHF stations. Connectivity to these stations should be provided at local dispatch centers so that dispatchers can monitor interoperability traffic and establish cross-band patches to allow 800 MHz users to communicate directly with VHF users. This interoperability solution is less robust than single band solutions since patching is limited to the number of repeater assets in the unused band. If an 8CALL station and a single 8TAC station are implemented, two channels in the 800 MHz band can be patched.

One primary limitation of this system is the acquisition of sufficient spectrum to accommodate VHF trunking systems. VHF spectrum is heavily licensed in the AACOG area. VHF stations are typically operated using CTCSS tones, which allow multiple VHF systems to exist co-channel without causing unwanted traffic to appear on victim receivers. Trunking systems are more susceptible to interference and require clean channels in order to function properly. Locating clean VHF channels sufficient to build out a regional trunking system will be very difficult, if not impossible. Before any plans are implemented to build out a hybrid VHF/700 MHz/800 MHz system, a study should be completed to determine if sufficient VHF spectrum exists.

7.2.2.2 Strengths and Weaknesses

Strengths and weaknesses of the VHF/700 MHz/800 MHz hybrid system include the following:

- Strengths
 - Provides interoperability on both a regional level and state level (system-of-systems)
 - Provides enhanced coverage and increased capacity
 - Users maintain a portion of existing VHF infrastructure
 - Simulcast solution that provides enhanced coverage without the need for users to switch channels or for dispatchers to monitor multiple channels
 - Minimal further investments in the development of new radio sites
- Weaknesses
 - Significant investment is required for region, requiring the purchase of new fixed infrastructure and subscriber radios to meet P25 compliance

- Increased capacity provided by trunking technology is not necessary throughout most of AACOG region
- Jointly owned system could create potential political conflicts regarding responsibilities of ownership and maintenance
- Sufficient VHF spectrum to build out a regional trunking system will be difficult, if not impossible to obtain
- Does not inherently solve interoperability gaps; multi-band radios or gateways must be utilized to bridge interoperability gaps between VHF users and 700/800 MHz users

7.2.2.3 Preliminary Estimated Costs

The following table lists the initial costs associated with the VHF/700 MHz/800 MHz hybrid trunking system.

Table 247 - VHF/700 MHz/800 MHz Hybrid Trunking System Preliminary Estimated Costs

Component	Cost per Unit	Quantity	Cost
VHF radio equipment at sites (four-channel simulcast capable)	\$350,000	22	\$7,700,000
Public safety microwave connectivity (One microwave hop per site, one per primary dispatch center)	\$150,000	33	\$4,950,000
Project Estimated Cost			\$12,650,000

For budgetary purposes, L.R. Kimball has assumed constructing the system using optimal technology and design. In addition, L.R. Kimball has made several assumptions regarding radio sites and equipment. A more detailed analysis is necessary to determine the exact specifications required for a regional VHF/700 MHz/800 MHz hybrid system. AACOG agencies need to understand that a regional shared system would require a total system design and procurement. It needs to be understood that constructing a shared system would require shared ownership of most core components, as well as shared governance and management of the system. The following details assumptions and possible cost savings initiatives.

- The cost estimate assumes that an average of 2 radio sites will be necessary to provide coverage throughout the existing counties currently operating in the VHF band, for a total of 22 radio sites.
- The estimate assumes one microwave hop per radio site and one additional hop per county to connect each sub-system with the system core in counties outside of the LCRA footprint. Cost savings may be recognized through the implementation of less expensive backhaul options, such as unprotected 4.9 GHz and/or leased T1 lines.
- The subscribers are assumed to be present market P25 VHF radios.
- The cost for a master site has not been included based on the assumption that a regional P25 radio system could share an existing P25 system core. The cost of a master site is approximately \$2,000,000.
- No costs have been included to build out additional radio towers. If additional tower sites are required, and no existing towers can be located in those locations requiring coverage, new towers may have to be constructed.

7.2.2.4 L.R. Kimball Recommendations

L.R. Kimball does not recommend this solution as the primary interoperability gaps between VHF and 700/800 MHz would not be addressed; however, there are clear benefits to be recognized from a shared P25 hybrid system should a coverage footprint be established in both frequency bands. Such a system would provide for future growth within the region and provide the infrastructure to support radio communications far into the future. As technology advances using multi-band radios, use of such a system becomes more practical. As the narrowbanding deadline approaches, clean VHF spectrum resulting from the reframing of the VHF band is likely to become more prevalent. While such a system is not recognizable within the next five years, L.R. Kimball recommends that AACOG consider a shared system in the future. In addition, L.R. Kimball recommends that short-term investments be made with long-term goals to support the eventual implementation of a shared regional system.

7.2.3 Interoperability Channel Gateway Solution

7.2.3.1 System Description

One cost effective solution available to the AACOG region is to implement a network of conventional gateways operating in the VHF, 800 MHz and 900 MHz frequency bands. Gateway solutions are able to function when two systems provide an overlapping coverage area. The gateway decodes the radio signal to an audio level and bridges the audio to the disparate radio systems. This design would allow all users to continue operating on their present radio systems. The gateways would provide a coverage footprint throughout the region in the frequency bands servicing all users in the AACOG. The gateways would require the build out of repeaters and base stations located at tower sites that provide the maximum coverage available. The system would be interfaced with each dispatch center. Dispatchers would have the ability to monitor traffic on the interoperability calling channels outlined in the TSICP, and patch incoming out-of-band traffic to local dispatch and tactical channels.

For example, a county with exclusive VHF users would install conventional repeaters operating in the 800 MHz and 900 MHz frequency bands. Control stations or microwave links located at the dispatch center or centers would provide dispatcher connectivity to the repeaters. Should a mutual aid response be necessary, incoming 800 MHz users from Bexar County could make a radio call on the 800 MHz calling channel. The local dispatcher would then patch the 800 MHz channel to the local dispatch channel or VHF interoperability channel, allowing cross-band communications.

For such a system to function, several key initiatives must take place:

- Upgrade radio consoles that do not support patching capability or that do not have capacity to accommodate additional channels
- Install base stations and repeaters at radio sites that provide the maximum coverage area while minimizing the total number of radio sites.
- Install equipment to provide backhaul connectivity between interoperability base stations and repeaters, and dispatch centers

Upgrade of the dispatch consoles to support console patching and capacity for additional radio channels is critical for this solution to be implemented. The ability to perform console patches is the minimum step necessary to establish communications between radio systems utilizing different frequency bands or incompatible technologies. At a

minimum, one patching-capable console is needed within each dispatch center; however, for operational purposes it is recommended that all consoles be upgraded to limit training problems by utilizing different console models.

The second essential component of this solution is to implement VHF, 800 MHz and 900 MHz base stations and repeaters at tower sites that provide maximum coverage. L.R. Kimball recommends that the stations be programmed to the interoperability calling channels in the VHF and 800 MHz frequency bands. The VHF station would be programmed to the TXLAW2 calling channel and would be reprogrammed to the VCALL channel prior to the narrowbanding deadline of January 1, 2013. A second 800 MHz repeater is recommended to support tactical communications on one of the 800 MHz tactical channels. No interoperability channels exist in the 900 MHz frequency band. Control stations can then be implemented to provide console connectivity in those counties within the LCRA footprint. Outside of the LCRA footprint, 900 MHz conventional repeaters would be programmed to a single licensed frequency to be designated as a 900 MHz interoperability channel. Gateway solutions, such as the one proposed, are limited in that coverage will be limited by the number of base stations. Typically, such interoperability systems are designed to provide countywide mobile coverage. Costs can be limited if equipment can be located on high towers with a maximum coverage footprint.

Lastly, a form of backhaul connectivity is recommended between interoperability base stations and repeaters, and dispatch centers. The VHF interoperability channels are single simplex channels rather than repeated channels. Without backhaul, these stations must be located at the dispatch center to provide connectivity on the dispatch console. This setup limits the available height of antennas to the roof of the dispatch center or any co-located radio towers. To provide ideal coverage, these stations must be located at the tallest radio sites available, which are not likely co-located with the dispatch center. Backhaul connectivity via a leased T1 line or microwave hop would allow these stations to be placed remotely on off-site radio towers. Interoperability channels in the 800 MHz band are repeated channels. Problems, however, result on these stations when the coverage areas from these systems overlap. When a user makes a radio call on an 800 MHz interoperability channel, and that channel is subsequently received by multiple radio sites, the result is a repeated signal that is returned at different rates. This has an echo effect. To properly manage these systems, backhaul connectivity is needed to invoke transmit inhibit on the station. The dispatcher would still monitor received traffic through the backhaul connection and turn on repeat capabilities on an incident-by-incident basis.

7.2.3.2 Strengths and Weaknesses

Strengths and weaknesses of the interoperability gateway solution include the following:

- Strengths
 - Provides capability for connectivity between all radio platforms in place today
 - Allows existing radio systems to remain relatively unchanged
 - Provides an inexpensive solution compared with system overhauls
 - Permits update of aged console equipment, increasing capabilities and capacity
 - Uses available assets on interoperability channels largely consistent with capacity of primary VHF systems
 - Backhaul connectivity between dispatch center and radio sites can be utilized in future simulcast or trunked system designs
- Weaknesses

- Patching is not real time, and requires dispatcher intervention
- Number of patches limited to number of interoperability assets
- Effectiveness of patch limited to coverage areas of both VHF and 700/800/900 MHz resources
- Backhaul solutions are typically large investments, although less expensive microwave options exist
- Coverage on interoperability repeaters is limited to individual radio sites
- Will not provide improved capacity to respond to an interoperability event
- Will not inherently provide improved operability for primary systems
- Will not provide a clear migration plan to P25

7.2.3.3 Preliminary Estimated Costs

The following are estimated costs to upgrade to an interoperable gateway solution.

Table 248 – Interoperable Gateway Solution Preliminary Estimated Costs

Component	Cost per Unit	Quantity	Cost
Interoperability repeaters(1 VHF, 2 800 MHz, 1 900 MHz)	\$30,000	88	\$2,640,000
Point to point connectivity	\$50,000	22	\$1,100,000
Total			\$3,740,000

For budgetary purposes, L.R. Kimball assumed constructing the system using optimal technology and design for the solution proposed. In addition, L.R. Kimball has made several assumptions regarding radio sites and equipment. AACOG agencies need to understand that a regional overlay system would require a great deal of overhead. The following details assumptions and possible cost savings initiatives:

- The cost estimate assumes that an average of two radio sites will be necessary to provide coverage throughout the existing counties currently operating in the VHF band.
- The cost estimate includes budgetary estimates for four P25 conventional repeaters per radio site. At two sites per county, this equates to 88 repeaters.
- It is assumed that no additional resources beyond those already planned are needed within Bexar County.
- The estimate assumes one microwave hop per radio site for a total of two per county. This equates to 22 total hops.
- Microwave costs have been quoted for less expensive point-to-point solutions that have less redundancy than conventional microwave, but will support audio and radio backhaul. Cost savings may be recognized through the use of leased T1 lines.
- Subscriber costs have not been included as these would be attributed to primary system upgrades.
- No costs have been included to build out additional radio towers. If additional tower sites are required and no existing towers can be located in those locations requiring coverage, new towers may have to be constructed.
- Costs have been included to develop additional radio sites that can be leased from the tower owners. Costs cover the development of radio shelters and facilities to support public safety communications.

7.2.3.4 L.R. Kimball Recommendations

L.R. Kimball does not support this option because the system will require a significant investment without significantly advancing the region toward P25 or shared systems. The network of interoperability repeaters would not improve primary system coverage or capacity, and would only provide a limited connection between frequency bands. However, interoperability repeaters are recommended as a component of the eventual solution. Conventional interoperability repeaters are a useful tool that allows for a radio connection at the minimal conventional level which is common in all radios. Interoperability repeaters will still be needed in some capacity to accommodate users from outside the region who do not have local frequencies programmed or do not have P25-capable equipment.

7.3 Regional System Technology

Based upon information presented to the AACOG stakeholders, a regional P25 system using a “system-of-systems” approach has been identified as the technology solution of choice for implementation. This system will take advantage of the LCRA proposal, utilizing existing LCRA tower sites, and developing new tower sites in the portions of the region not currently covered by LCRA.

AACOG has committed to funding the fixed infrastructure portion of the project. Individual agencies would then be responsible for funding subscriber equipment and subscriber fees to LCRA to operate on the system. The system will utilize Harris fixed infrastructure connected to the LCRA VIDA switch in Austin. The network utilizes microwave as the primary backhaul connection, although fiber and leased lines are also used along some of the networks paths. ISSI interfaces are planned on the network to interface with P25 systems in adjoining regions.

Since the system will be P25-based users will have the flexibility to purchase any P25 compliant radios they wish. However, since the system will operate in the 700 MHz band, user radios must meet the 6.25 kHz channel efficiency requirement by 2017. This implies P25 Phase II capability. While there are many P25 Phase I radios on the market today, there are only several radios that will be upgradeable to Phase II. Radios on the market today that will support Phase II with software and/or hardware upgrades include the Motorola APX series, Harris 5200 series, Harris 7200 series, Harris 7300 series, Harris Unity, and E.F. Johnson 5100 ES series.

The existing LCRA network covers the AACOG counties of Gillespie, Kendall, Kerr, Bandera, Comal and Guadalupe. Once built out, the system will be expanded to cover Atascosa, Frio, Karnes, Medina, and Wilson. Coverage will not be extended within Bexar County as there are already plans for the COSA/Bexar County system to eventually upgrade to P25. The VIDA switches for COSA and LCRA will be interconnected to allow seamless roaming between the two systems.

The following map outlines the design proposed by LCRA:

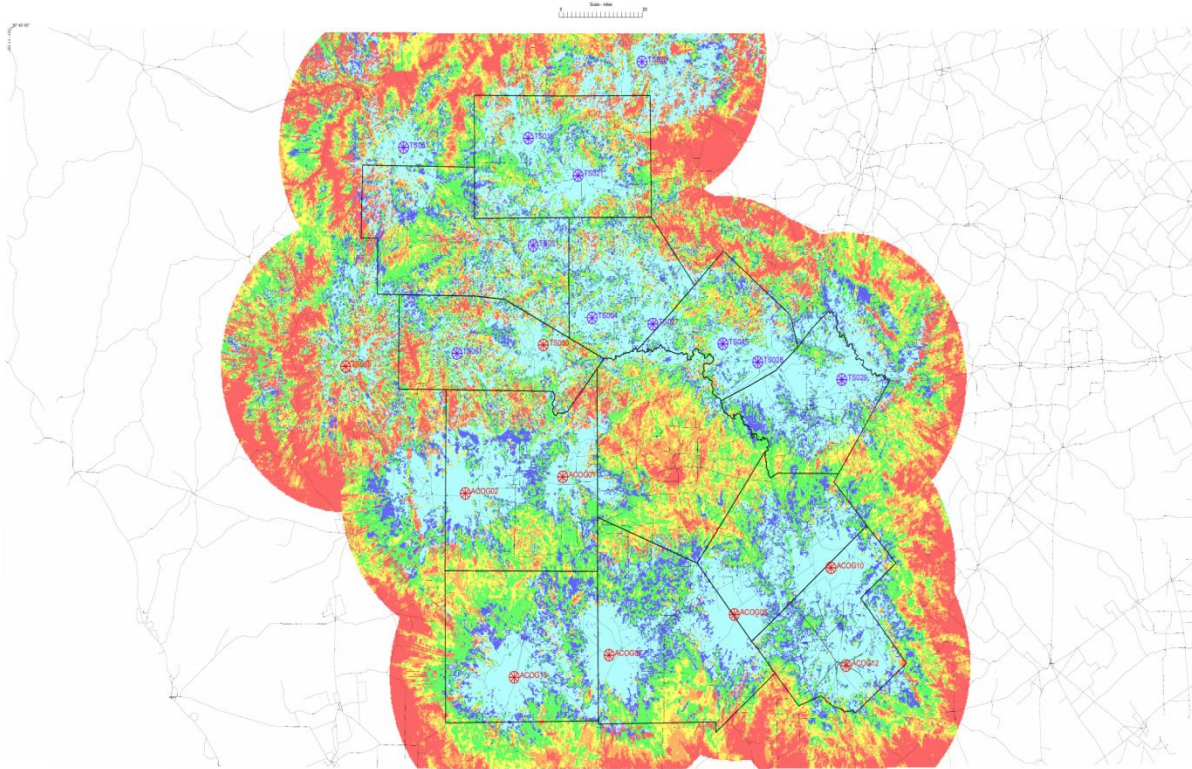


Figure 83 – LCRA P25 Proposed Design

7.3.1 Regional System Migration Plan

There are several key milestones that must be considered when implementing the regional P25 system. These include:

January 1, 2013—Several agencies have plans to migrate primary operations to the regional system, which will require operation prior to the narrowbanding deadline of January 1, 2013. The purpose would be to avoid spending money on both narrowbanding and 700 MHz radios. Specific sites within the regional system will need to be operational prior to January 1, 2013. Some of these sites will include areas not currently within the LCRA network.

End of 2014—Since the LCRA system is migrating to OpenSky, users currently on the LCRA need to have a P25 option before operation ceases on the EDACS system.

End of 2015—While P25 compliance is targeted as a vision more so than a requirement in the SCIP, the end of 2015 has been targeted as the completion date for the regional system. This will align with requirements to meet P25 requirements in the TSICP, which require interoperability channels to operate in the P25 conventional mode by January 1, 2015.

The following sections outline the step-by-step process L.R. Kimball recommends for implementing the regional system. It is understood that construction of the system will be the primary responsibility of LCRA. The primary focus of the migration plan is to assure key milestones are met and implementation aligns with local changes.

2011 (Second Half)

It is anticipated that initial efforts undertaken to develop this system will start during the third quarter of 2011. This will permit the completion of the RICP, which will encompass the final regional and local plans to be submitted to TXDPS. During this period, AACOG and LCRA will negotiate a contract for implementation of the system. The contract will include a final design, inclusive of site selection, coverage requirements, microwave/backhaul specifications, service/maintenance specifications, schedule, backup power specifications, testing procedures and RF equipment specifications. LCRA will begin the process of making arrangements for use of leased towers in those areas not currently covered by the LCRA system.

No system costs are anticipated during 2011.

Estimated Cost: \$0

2012 (First Half)

During this phase (Phase I), LCRA will begin the initial build out of radio sites in the P25 system. Initial build out for the system will target those counties that are currently on the LCRA network and will require a P25 alternative before the EDACS system is decommissioned. Implementation during Phase I is targeted for the counties of Wilson, Gillespie, Kerr, and Comal. These counties include all of the existing public safety users on the LCRA 900 MHz system. 700 MHz P25 coverage has already been built out within Guadalupe County along Interstate 10.

Build out of the regional system is targeted during 2012 to permit VHF primary users within the counties a 700 MHz migration option before the narrowbanding deadline. Specifically, 700 MHz migration is targeted for Wilson County Fire/EMS, Gillespie County Fire/EMS and Kerr County VFDs. These users require additional radio replacements to meet the narrowbanding deadline, and a 700 MHz migration will eliminate the need to duplicate funds for both narrowbanding and a 700 MHz migration.

Because the radio sites are currently in the LCRA network, 700 MHz implementation will strictly involve the deployment of radio equipment with associated antenna systems. Radio towers, shelters, and backhaul networks are already deployed and will support the additional radio equipment.

Radio equipment will be ordered during the first half of 2012 for deployment during the second half of 2012.

Cost estimates for this phase are associated with approximately one-half of the Phase I costs. Phase I includes the deployment of P25 radio equipment at existing sites in the LCRA network.

Estimated Cost: \$1,500,000

2012 (Second Half)

During this period, installation will commence on the eight radio sites identified in Phase I. Equipment installed will include repeaters, site controllers, routers, switches, and any other equipment needed to assure the sites are fully functional and interconnected with the P25 switch at the LCRA facility in Austin. During the fourth quarter of 2012, VHF wideband users in Wilson and Kerr Counties will cut over a portion of their operations to the LCRA system. Users that will cutover include those users who presently have wideband-only radios. Existing VHF systems will be permanently patched through the LCRA switch to designated talk groups for each agency within Kerr, Gillespie, and Wilson Counties. Audio will be passed from the VHF primary sites to the LCRA sites through control stations. Audio from the control stations will be passed through the backhaul network back to the VIDA conventional gateway.

Costs for this section are strictly limited to half of the costs for the eight Phase I sites. Associated subscriber equipment and patching interfaces have been attributed to individual agencies.

Estimated Cost: \$1,500,000

2013 (First Half)

During the first half of 2013, it is anticipated that the remaining users within Wilson and Gillespie County will migrate to the 700 MHz system. This includes Gillespie County law enforcement, Wilson County law enforcement, and New Braunfels who currently operate on the LCRA 900 MHz EDACS system.

Preparation will begin for the implementation of radio equipment in "Phase II." Phase II will include radio equipment in the counties of Wilson, Karnes, and Atascosa. This area includes four new radio sites that are not currently in the LCRA network. Radio site development is anticipated during 2013 for radio equipment deployment during 2014.

Radio site development will require the identification of tower sites that provide optimal coverage. This may include leased tower sites or the construction of new sites. Radio sites should be provided with adequate shelters, backup power, HVAC systems, and grounding to support reliable communications. Backhaul networks will need to be established for the radio sites.

Estimated costs during this period are associated with one-third of the Phase II costs.

Estimated cost: \$525,000

2013 (Second Half)

During this time period, it is anticipated that radio site development will continue for the Phase II radio sites. L.R. Kimball recommends that radio equipment be ordered for installation during 2014.

Estimated costs during this period are associated with one-third of the Phase II costs.

Estimated Cost: \$525,000

2014 (First Half)

During this time period, it is anticipated that radio equipment for Phase II will be installed in Atascosa, Wilson, and Karnes Counties.

L.R. Kimball recommends that radio site development begin for “Phase III,” which includes the counties of Bandera, Medina, and Frio. This area includes five new LCRA tower sites.

Estimated costs during this period are associated with one-third of the Phase II costs.

Estimated Cost: \$525,000

2014 (Second Half)

During this period, radio site development will continue for the Phase III tower sites. Equipment will be ordered for the Phase III radio sites for installation during 2015.

Estimated costs are associated with one-third of the Phase III costs.

Estimated Cost: \$525,000

2015

Installation of the Phase III equipment will be completed during 2015. Following equipment installation, final acceptance testing for the regional system will be performed.

Estimated costs are associated with two-thirds of the Phase III costs.

Estimated Cost: \$1,050,000

Ongoing Costs

Ongoing system maintenance costs will be recovered through user subscriber fees. Subscriber fees have been attributed to the individual agencies.

Cost Breakdown by Year

The following table breaks down the system cost on a year-by-year basis.

Table 249 – Cost Breakdown by Year

Year	Amount	Description
2011	\$0	Contract negotiation
2012	\$3,000,000	Installation of 700 MHz equipment at existing LCRA tower sites
2013	\$1,050,000	Radio site development and equipment installation at new network sites
2014	\$1,050,000	Radio site development and equipment installation at new network sites
2015	\$1,050,000	Radio site development and equipment installation at new network sites
Total Cost	\$6,150,000	

7.4 Primary System Recommendations

7.4.1 Atascosa County

As indicated in the baseline systems assessment, there are several underlying operability and interoperability gaps present within Atascosa County today. To summarize these gaps, the following list has been provided.

Coverage—Coverage is provided for the Atascosa County radio systems by conventional radio sites located in the center of the county and by satellite receivers. User feedback indicated radio coverage on the system is insufficient.

Conventional architecture—Addition of more transmitters in the conventional architecture will introduce operational difficulties for first responders and dispatchers.

Site Conditions—Radio site conditions are below the industry standard for reliable communications.

Interoperability—Interoperability is limited with users in the 800 or 900 MHz bands.

7.4.1.1 Recommended System

Based on the needs of Atascosa County expressed by system users and determined by L.R. Kimball, it is recommended that the County implement a five-channel conventional simulcast system shared by all public safety agencies within Atascosa County. The system will provide enhanced coverage throughout the county. The system will operate in the digital mode, making use of existing purchases of VHF P25 subscriber equipment and aligning system goals with State goals to build out P25 systems by 2015. The system will consist entirely of components that can be upgraded to VHF trunking operation once capacity needs justify the upgrade. Radio sites will be enhanced to meet industry standards for reliable communication in coordination with the installation of additional radio equipment. L.R. Kimball recommends reusing existing Motorola CENTRACOM Gold Elite consoles, with upgrades to support channel patching. Reuse of existing VHF spectrum will be planned; however, a licensing analysis is needed to determine if existing channels will be suitable in a simulcast configuration free from interference. Additional channels may be necessary if existing spectrum cannot be used throughout the county, and so “swing” channels can be used during system cutover.

L.R. Kimball recommends that the existing radio sites used for satellite receivers be evaluated to determine applicability for use in a conventional simulcast system. Reuse of the existing radio sites and backhaul equipment will result in cost savings for Atascosa County.

L.R. Kimball recommends that Pleasanton, Jourdanton, and Lytle continue to upgrade their existing subscriber equipment and repeater sites to P25 conventional operation.

To permit ongoing analog paging, L.R. Kimball recommends that analog repeaters be placed at the primary Atascosa County tower and at an additional tower at the west side of the county. The repeaters may use the same frequency with different CTCSS tones to permit countywide paging dispatch.

Interoperability will be enhanced through a gateway connection to the regional P25 system. The law enforcement and fire dispatch channels will be permanently patched to the 700 MHz system, permitting response to the area from users from San Antonio or other 700/800 MHz systems. To permit 800 MHz interoperability with users who may not have the appropriate channels programmed on the regional 700/800 MHz system, L.R. Kimball recommends that Atascosa County implement an 800 MHz repeater on the 800 MHz calling channel. A base station on the VHF calling channel should also be implemented and tied into the dispatch consoles.

In the five to ten year time frame, L.R. Kimball recommends that Atascosa County explore migration to the regional 700 MHz system.

The following table summarizes the channels as they will appear in the system:

Table 250 – Atascosa County System Channels

Channel	Description
Channel 1	Sheriff Dispatch
Channel 2	Law Enforcement Tactical
Channel 3	Fire/EMS Dispatch
Channel 4	Fire/EMS Tactical

The following table summarizes details regarding the recommended system for Atascosa County:

Table 251 – Atascosa County Radio System Details

Channel	Description
Number of Radio Sites in System:	3
Number of Channels in System:	4
Frequency Band:	VHF
Trunking or Conventional:	Conventional
Simulcast (Yes or No)	Yes
Technology (NB analog, P25, etc)	P25
Coverage Requirement	95% Outdoor Portable at hip-level
Number of Console Positions:	3
Number of subscriber units on system:	Approximately 200
System Reliability	99.999%
Encryption	Supported
Telephone Interconnect	No
Private Call	No
Growth Flexibility	Core components will support upgrade to trunking and addition of radio sites if needed
Automatic Vehicle Location	No

Channel	Description
Emergency Features	Emergency Alert
Specialized Equipment	Mobile Gateway
Equipment Standardization	P25 capable. Vendor/model selection variable.
Channel Scan	Yes
Unit ID	Yes
Improved Audio Quality	Digital Audio Quality Using Enhanced Full Rate Vocoder
New Equipment	Analog subscribers will be replaced with P25 subscribers. Core infrastructure will require of addition of tower sites, repeaters, digital voters, simulcast equipment, and backhaul.
Paging and Alert Systems	Maintained in analog mode on separate channel

7.4.1.2 Cost Estimate

The cost estimate is based on averages for list prices of the typical components of a system with this design. Specific designs will vary in price. Cost savings may be recognized by reusing existing equipment. This determination will ultimately be made by the selected vendor.

Table 252 – Atascosa County Cost Estimates

Component	Cost per Unit	Quantity	Cost
Radio Sites	\$350,000	3	\$1,050,000
Subscriber Equipment (VHF P25 and narrowbanding)	\$2,000	200	\$400,000
Municipal PD P25 Repeater Upgrades	\$30,000	4	\$120,000
VHF Interoperability Base Station	\$30,000	1	\$30,000
800 MHz Interoperability Repeater	\$30,000	1	\$30,000
700 MHz Control Stations	\$10,000	3	\$30,000
Licensing Fees	\$10,000	1	\$10,000
VHF Sub-total			\$1,670,000
Subscriber Upgrades (700 MHz)	\$3,500	300	\$1,050,000
Total			\$2,720,000
Maintenance Fees	\$40,750 / year		\$40,750 / year
Ongoing Costs			\$40,750 / year

7.4.1.3 Migration Plan

There are several key milestones that must be considered when implementing the Atascosa County system. These include:

January 1, 2013—Because analog channels within Atascosa County are still operated in the wideband mode, all equipment must be upgraded to meet narrowbanding compliance prior to January 1, 2013.

End of 2015—The end of 2015 has been targeted as the completion date for the implementation of P25 systems. This migration strategy plan aligns with that goal.

2011

Since a funding source is not immediately available to build out a countywide simulcast system, it is anticipated that 2011 will provide time to identify such a source. This will provide time for the evaluation of the AACOG RICP, which could in turn provide a potential funding source if money is awarded by the state legislature.

During this period, L.R. Kimball recommends that Atascosa County continue to replace wideband analog subscriber equipment with subscribers that will support P25 VHF conventional communications.

Cost estimates are based on the replacement of approximately half of the remaining analog radios.

Estimated Cost: \$200,000 (replacement of 100 subscriber radios)

2012 (First Half)

Once a funding source has been identified, a vendor must be selected to provide the system. In general, L.R. Kimball recommends a form of competitive procurement to assure system costs are minimized. However, Atascosa County may choose to procure the system with their vendor of choice. Taking long-term migration to a trunking system into consideration, the repeater equipment vendor must match that of the trunking controller vendor. Both Harris and Motorola P25 switches are available in the region that could ultimately be used to control an Atascosa County trunking system.

During this period, it is anticipated that Atascosa will identify an equipment vendor and negotiate a contract to build the system. The contract will include a final design, inclusive of: site selection, coverage requirements, microwave/backhaul specifications, service/maintenance specifications, schedule, backup power specifications, testing procedures and RF equipment specifications. The process will include the development of a system design that will provide a guaranteed coverage level of 95 percent portable coverage for a subscriber unit at hip level.

Once sites have been finalized with a vendor, Atascosa County will undertake a licensing effort to “reshuffle” existing VHF channels to a simulcast configuration.

Expenses will correspond with P25 upgrades for subscriber equipment used by the VFDs within Atascosa County, and consulting/coordination fees to perform an analysis of VHF spectrum. It is estimated that approximately 100 radios will require replacement.

Estimated Cost: \$210,000 (replacement of 100 subscriber radios and licensing fees)

2012 (Second Half)

During the second half of 2012, Atascosa County will begin installation of the radio system. The first focus of the process will be to assure all subscriber equipment is operating in a narrowband mode to demonstrate compliance

with the FCC narrowbanding mandate. Base stations will be reprogrammed in the narrowband mode. If VHF base stations are being used that are not narrowbanding capable, then base stations planned to be utilized for the simulcast system will replace the wideband base stations on a temporary basis.

During this period the initial shipment of equipment will be ordered. Site acquisition and development will take place to build out new radio sites not currently utilized by Atascosa County. These sites will likely require the installation of the shelters, complete with concrete foundation, pre-fabricated concrete structure, equipment racks, HVAC systems, antenna systems, feed lines, UPS systems, generator, and grounding systems consistent with industry standards. Site enhancements should be made to existing Atascosa County facilities to bring these facilities up to the industry standard for reliable radio communications.

Interoperability repeaters and municipal repeater systems should be upgraded during this period.

Estimated cost: \$705,000 (half of system infrastructure costs, consoles, and repeater replacements)

2013 (First Half)

During the first half of 2013, it is anticipated that staging and installation of the system will take place. Staging should include a complete build out of the radio system infrastructure in a laboratory setting to demonstrate proof of performance. Once performance during staging has been verified by Atascosa County representatives, the vendor will be permitted to install the equipment at the appropriate tower locations.

Estimated cost: \$262,500 (one-quarter of simulcast system costs)

2013 (Second Half)

During the second half of 2013, it is anticipated that system testing will take place. System testing will include drive testing to assure that the system provides the coverage levels contractually obligated by the vendor. System testing will include "talk out" and "talk back" audio quality testing, including selected buildings consistent with the vendor contract. System testing will include proof of concept with dispatch console use and all radio features. Once testing has been completed, Atascosa County will provide an initial acceptance of the system.

Once the system is accepted, Atascosa County will migrate users to the new system. Cutover will be accomplished one channel at a time. Swing channels, if available, will be used. During the actual cutover, traffic can be routed to TXLAW2 or other interoperability channels. Subscriber equipment will remain the same, so cutover is anticipated to be relatively seamless.

Estimated cost: \$262,500 (one-quarter of simulcast system costs)

2014

L.R. Kimball recommends that Atascosa County interface with the regional 700 MHz P25 system, once it has been built out within the county, using three control stations. The control stations will tie in to the dispatch consoles and permit patching between the countywide Atascosa County channels and talk groups on the regional system.

Estimated cost: \$30,000 (three P25 700 MHz control stations)

2015 – 2020

L.R. Kimball recommends that Atascosa County evaluate the regional 700 MHz system as a future option, once the system has been well established within the region. Eventual migration to the system would require the replacement of all subscriber equipment with P25 trunking-capable 700/800 MHz radios.

Estimated cost: \$1,050,000

Ongoing Costs:

Estimated cost per year: \$40,750 (maintenance fees)

Cost Breakdown by Year

The following table breaks down the system cost on a year-by-year basis.

Table 253 – Atascosa County Cost Breakdown by Year

Year	Amount	Description
2011	\$200,000	Subscriber replacements
2012	\$915,000	Subscriber replacements, licensing fees, half of system replacement costs, and repeater upgrades
2013	\$525,000	System installation, testing, and cutover
2014	\$30,000	Regional system interface; system maintenance covered under warranty
2015	\$40,750	System maintenance fees
2016	\$40,750	System maintenance fees
2017	\$40,750	System maintenance fees
2018	\$40,750	System maintenance fees
2019	\$40,750	System maintenance fees
2020	\$1,090,750	System maintenance fees and subscriber upgrades
Total Cost 2011-2020	\$2,964,500	

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7.4.1.4 Funding Gap

The following table summarizes the estimated funding gap based upon past and present future funding sources identified by Atascosa County:

Table 254 – Atascosa County Funding Gap

	Amount
Past Expenditures (2006 – 2010)	\$258,000
Future Funding (2011 – 2020)	--
Estimated Costs (2011 – 2020)	\$2,964,500
Total Funding Gap 2011 – 2020	\$2,964,500

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7.4.2 Bandera County

As indicated in the baseline systems assessment, there are several underlying operability and interoperability gaps present within Bandera County today. To summarize these gaps, the following list has been provided.

Conventional architecture—The Bandera County system uses seven channels spread across six different locations between the law enforcement and fire systems. Extensive use of multiple conventional radio sites and channels creates operational problems for system users.

Coverage—As confirmed by propagation analysis, coverage is a major problem within Bandera County. Many coverage gaps exist in the western half of the county, in particular due to challenging terrain.

Site Conditions—Radio site conditions are below the industry standard for reliable communications. Resources are split between multiple radio sites that provide equivalent coverage.

Interoperability—Interoperability is limited to shared VHF channels with adjacent jurisdictions.

7.4.2.1 Recommended System

Based on the needs of Bandera County expressed by system users and determined by L.R. Kimball, it is recommended that the County implement a five-channel conventional simulcast system shared by all public safety agencies within Bandera County. The system will provide enhanced coverage throughout the county, permitting seamless roaming of users from radio site to radio site without the need to switch channels. The system will operate in the digital mode, making use of existing purchases of VHF P25 subscriber equipment and aligning system goals with State goals to build out P25 systems by 2015. The system will consist entirely of components that can be upgraded to VHF trunking operation once capacity needs justify the upgrade. Radio sites will be enhanced to meet industry standards for reliable communications in coordination with the installation of additional radio equipment.

Where possible, the system will incorporate recent expenditures on repeaters, subscriber equipment, consoles, and radio sites. At a minimum, P25 subscriber radios and new consoles will operate without a problem on the system.

Reuse of existing VHF spectrum will be planned; however, a licensing analysis is needed to determine if existing channels will be suitable in a simulcast configuration free from interference. Additional channels may be necessary if existing spectrum cannot be used throughout the county and so “swing” channels can be used during system cutover. Bandera County currently has seven VHF repeater pairs licensed. It is anticipated that five of these channels will be utilized within the simulcast system, and two will be maintained for analog paging and for communication with analog radio users who are not equipped with P25 radios. Due to challenges associated with lining up VHF channels in a simulcast configuration, it is likely additional channels will be required.

Local entities, including municipalities and VFDs, may continue to operate their own repeater or simplex systems to supplement the countywide system. These systems may continue to operate in the analog mode permitting that subscriber equipment is P25 capable and can operate on the county system for mutual aid or response outside the coverage area of the home repeater systems. Channels will likely need to be shuffled with some of the local repeater channels used today for use in the countywide system.

Radio site selection will ultimately be decided by the selected vendor to meet Bandera County defined coverage requirements. L.R. Kimball recommends that Bandera County target a coverage requirement of 90 percent outdoor portable at hip-level.

In the event a funding source is not immediately available for the entire system, radio sites can be integrated in a simulcast configuration one at a time. A coverage design should be targeted before the implementation of any specific radio sites so that the coverage goal can be pre-defined and the minimal number of radio sites necessary to provide adequate coverage will be identified. Microwave backhaul is recommended for connectivity between radio sites if direct paths can be identified.

To facilitate interoperability with VHF and 800 MHz users who may not have the appropriate channels or talk groups programmed in their radios, L.R. Kimball recommends that Bandera County implement conventional repeater stations on the VHF and 800 MHz interoperability calling channels.

In the five to ten year time frame, L.R. Kimball recommends that Bandera County explore operation on the 700 MHz regional system.

The following table summarizes channels that will appear in the system.

Table 255 – Bandera County System Channels

Channel	Description
Channel 1	Law Enforcement Dispatch
Channel 2	Law Enforcement Tactical
Channel 3	EMS Dispatch / TAC
Channel 4	Fire Dispatch
Channel 5	Fire Tactical

The following table summarizes details regarding the recommended system for Bandera County:

Table 256 – Bandera County Radio System Details

Channel	Description
Number of Radio Sites in System:	5
Number of Channels in System:	5
Frequency Band:	VHF
Trunking or Conventional:	Conventional
Simulcast (Yes or No)	Yes
Technology (NB analog, P25, etc)	P25
Coverage Requirement	90% Outdoor Portable at hip-level
Number of Console Positions:	2

Channel	Description
Number of subscriber units on system:	Approximately 400
System Reliability	99.999%
Encryption	Supported
Telephone Interconnect	No
Private Call	No
Growth Flexibility	Core components will support upgrade to trunking and addition of radio sites if needed
Automatic Vehicle Location	No
Emergency Features	Emergency Alert
Specialized Equipment	Mobile Gateway
Equipment Standardization	P25 capable. Vendor/model selection variable.
Channel Scan	Yes
Unit ID	Yes
Improved Audio Quality	Digital Audio Quality Using Enhanced Full Rate Vocoder
New Equipment	Analog subscribers will be replaced with P25 subscribers. Core infrastructure will require addition of tower sites, repeaters, digital voters, simulcast equipment, and backhaul.
Paging and Alert Systems	Maintained in analog mode on separate channel

7.4.2.2 Cost Estimate

The cost estimate is based on averages for list prices of the typical components of a system with this design. Specific designs will vary in price. Cost savings may be recognized by reusing existing equipment. This determination will ultimately be made by the selected vendor.

Table 257 – Bandera County Cost Estimates

Component	Cost per Unit	Quantity	Cost
Cost per Site	\$350,000	5	\$1,750,000
Licensing fees and analysis	\$10,000	1	\$10,000
Subscriber Equipment	\$2,000	300	\$600,000
800 MHz Interoperability Repeater	\$30,000	1	\$30,000
VHF Interoperability Base Station	\$30,000	1	\$30,000
700 MHz control Stations	\$10,000	3	\$30,000
VHF System sub-total			\$2,450,000
700 MHz Subscribers	\$3,500	400	\$1,400,000
Total			\$3,850,000
Maintenance Fees	\$61,250 / year		\$61,250 / year

Component	Cost per Unit	Quantity	Cost
Ongoing Costs			\$61,250 / year

7.4.2.3 Migration Plan

There are several key milestones that must be considered when implementing the Bandera County system. These include:

January 1, 2013—Because analog channels within Bandera County are still operated in the wideband mode, all equipment must be upgraded to meet narrowbanding compliance prior to January 1, 2013.

End of 2015—The end of 2015 has been targeted as the completion date for the implementation of P25 systems. This migration strategy plan aligns with that goal.

2011

Since a funding source is not immediately available to build out a countywide simulcast system, it is anticipated that 2011 will provide time to identify such a source. This will provide time for the evaluation of the AACOG RICP, which could in turn provide a potential funding source if money is awarded by the state legislature.

During this period, L.R. Kimball recommends that Bandera County continue to replace wideband analog subscriber equipment with subscribers that will support P25 VHF conventional communication.

Cost estimates are based on the replacement of approximately 200 analog radios.

Estimated Cost: \$400,000 (replacement of 200 subscriber radios)

2012 (First Half

Once a funding source has been identified, a vendor must be selected to provide the system. L.R. Kimball recommends a form of competitive procurement to assure system costs are minimized. However, Bandera County may choose to procure the system with their vendor of choice. Taking long-term migration to a trunking system into consideration, the repeater equipment vendor must match that of the trunking controller vendor. Both Harris and Motorola P25 switches are available in the region that could ultimately be used to control the Bandera County trunking system.

During this period, it is anticipated that Bandera County will identify an equipment vendor and negotiate a contract to build the system. The contract will include a final design, inclusive of site selection, coverage requirements, microwave/backhaul specifications, service/maintenance, schedule, backup power specifications, testing procedures and RF equipment specifications. The process will include the development of a system design that will provide a guaranteed coverage level of 90 percent portable coverage for a subscriber unit at hip level.

Once sites have been finalized with a vendor, Bandera County will undertake a licensing effort to “reshuffle” existing VHF channels to a simulcast configuration.

Expenses will correspond with P25 upgrades for subscriber equipment used by VFDs within Bandera County, and consulting/coordination fees to perform an analysis of VHF spectrum. At this time, the number of non-P25 radios is not known.

Estimated Cost: \$210,000 (replacement of 100 subscriber radios and licensing fees)

2012 (Second Half)

During the second half of 2012, Bandera County will begin installation of the radio system. The first focus of the process will be to assure all subscriber equipment is operating in a narrowband mode to demonstrate compliance with the FCC narrowbanding mandate. Base stations will be reprogrammed in the narrowband mode. If VHF base stations are being used that are not narrowbanding capable, then base stations planned to be utilized for the simulcast system will replace the wideband base stations on a temporary basis.

During this period the initial shipment of equipment will be ordered. Site acquisition and development will take place to build out new radio sites not currently utilized by Bandera County. These sites will likely require the installation of the shelters, complete with concrete foundation, pre-fabricated concrete structure, equipment racks, HVAC systems, antenna systems, feed lines, UPS systems, generator, and grounding systems consistent with industry standards. Site enhancements should be made to existing Bandera County facilities to bring these facilities up to the industry standard for reliable radio communications.

Estimated cost: \$875,000 (half of infrastructure costs)

2013 (First Half)

During the first half of 2013, it is anticipated that staging and installation of the system will take place. Staging should include a complete build out of the radio system infrastructure in a laboratory setting to demonstrate proof of performance. Once performance during staging has been verified by Bandera County representatives, the vendor will be permitted to install the equipment at the appropriate tower locations.

Consoles will be configured to support channel patching. Interoperability base stations in the VHF and 800 MHz band will be installed.

Estimated cost: \$497,500 (one-quarter of infrastructure costs, and interoperability base stations)

2013 (Second Half)

During the second half of 2013, it is anticipated that system testing will take place. System testing will include drive testing to assure that the system provides the coverage levels contractually obligated by the vendor. System testing will include "talk out" and "talk back" audio quality testing, including selected buildings consistent with the vendor contract. System testing will include proof of concept with dispatch console use and all radio features. Once testing has been completed, Bandera County will provide an initial acceptance of the system.

Once the system is accepted, Bandera County will migrate users to the new system. Cutover will be accomplished one channel at a time. Swing channels, if available, will be used. During the actual cutover, traffic can be routed to TXLAW2 or other interoperability channels. Subscriber equipment will remain the same, so cutover is anticipated to be relatively seamless.

Estimated cost: \$437,500 (one-quarter of infrastructure costs)

2014

L.R. Kimball recommends that Bandera County implement 700 MHz control stations to tie into the regional 700 MHz system once it has been installed within Bandera County.

Estimated cost: \$30,000 (three 700 MHz control stations)

2015 – 2020

L.R. Kimball recommends that Bandera County explore the 700 MHz regional system as an option in the future. The system must provide adequate coverage throughout Bandera County if the system is to be considered.

Estimated cost: \$1,400,000 (replacement of approximately 400 subscriber radios)

Ongoing Costs

Ongoing costs are attributed to a preventive maintenance program. Estimated costs are approximately 2.5 percent of the system costs.

Estimated cost per year: \$61,250

Cost Breakdown by Year

The following table breaks down the system cost on a year-by-year basis.

Table 258 – Bandera County Cost Breakdown by Year

Year	Amount	Description
2011	\$400,000	Subscriber radio purchases
2012	\$1,085,000	Subscriber replacements and infrastructure costs
2013	\$935,000	Infrastructure costs, and interoperability repeaters
2014	\$30,000	700 MHz connectivity
2015	\$61,250	System maintenance
2016	\$61,250	System maintenance
2017	\$61,250	System maintenance
2018	\$61,250	System maintenance
2019	\$61,250	System maintenance
2020	\$1,400,000	700 MHz subscribers
Total Cost 2011-2020	\$4,156,250	

7.4.2.4 Funding Gap

The following table summarizes the estimated funding gap based upon past and present future funding sources identified by Bandera County:

Table 259 – Bandera County Funding Gap

	Amount
Past Expenditures (2006 – 2010)	\$134,794
Future Funding (2011 – 2020)	\$115,000
Estimated Costs (2011 – 2020)	\$4,156,250
Total Funding Gap 2011 – 2020	\$4,041,250

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7.4.3 Bexar County

Bexar County presents the most complex radio environment within the AACOG region. Most radio users within the region utilize the COSA/Bexar County 800 MHz EDACS system or are in the process of migrating to the system. Other systems include the Live Oak system, Bexar County Fire Alarm, Leon Valley, and systems belonging to local municipalities that maintain VHF primary communications.

Since the complexity of the Bexar County radio environment, primary radio upgrades have been defined in the form of strategic initiatives targeted at addressing the communications gaps within the county.

These initiatives include:

- Migrating all local government agencies within Bexar County to the COSA/Bexar County 800 MHz radio system, including users on the Bexar County Fire Alarm system
- Enhancing VHF communications on the Fire Alarm system to improve coverage and capacity until all users can migrate to the 800 MHz system
- Upgrading the COSA/Bexar County system to P25
- Integrating the Live Oak system with COSA/Bexar County
- Building out an LTE system within Bexar County

7.4.3.1 COSA/Bexar County Migration

Based on coverage, capacity, and reliability of the COSA/Bexar County system, L.R. Kimball strongly recommends that all public safety radio users within Bexar County migrate to the COSA/Bexar County 800 MHz system. This recommendation is promulgated by the following:

- Most users within the immediate surrounding area already use the COSA/Bexar County system for primary communications. VHF users are largely on a communications “island,” in some cases with limited connectivity to the 800 MHz system. The COSA/Bexar County system will ultimately upgrade to P25, aligning with State-defined goals. VHF primary systems utilize conventional analog architectures that provide limited functionality compared to the COSA/Bexar County system. Access to the system is an opportunity that should be explored.
- As a tenant on the COSA/Bexar County system, local agencies do not need to manage ongoing operations and maintenance costs associated with managing their own radio systems.
- Migrating to the COSA/Bexar County system is a solution for narrowbanding that could leverage necessary expenses with long-term goals.
- Migrating to 800 MHz will permit communication throughout the entire COG on the regional P25 system.

There are several key milestones that must be considered. These include:

January 1, 2013—Because analog channels within Bexar County are still operated in the wideband mode, all equipment must be upgraded to meet narrowbanding compliance prior to January 1, 2013.

End of 2015—The end of 2015 has been targeted as the completion date for the implementation of P25 systems. This migration strategy plan aligns with that goal.

L.R. Kimball understands the funding limitations associated with subscriber replacements. Migration of VHF primary systems to the COSA/Bexar County system will require that all radios within a given fleet be 700/800 MHz Harris EDACS and P25 capable radios. This is the primary expense associated with migration to the system. L.R. Kimball has targeted a migration plan that allows for the phased implementation of 800 MHz radios as existing radios reach the end of their life cycle. Following migration to the system, expenses will be primarily based on subscriber fees.

Cutover plans to the COSA/Bexar County system are already in place for Castle Hills, Helotes, and Kirby. Major municipalities or agencies with no current plans for migration to the system include Leon Valley and Bexar County Fire Alarm.

7.4.3.1.1 Leon Valley

Equipment on the Leon Valley system is narrowbanding capable; however, reprogramming is needed for the system to operate in the narrowbanding mode prior to the narrowbanding deadline. Migration dates are associated with meeting the State's initiative to achieve P25 compliance by the end of 2015.

The migration strategy outlined provides the ability for Leon Valley to migrate subscriber radios to the COSA/Bexar County system over a period of years. This strategy permits subscribers to be replaced as they malfunction or reach the end of their intended life. Designated talk groups on the COSA/Bexar County system will be gateway connected with the primary Leon Valley channels. As subscriber radios require replacement, new radios will be purchased to operate on the COSA/Bexar County system. The gateway connection will provide the ability for radio traffic on one system to be repeated on the other system. Mobile-to-mobile talkaround will not be available during the transition period for users operating in different frequency bands. The end of 2015 is targeted for the complete replacement of all Leon Valley subscriber radios with P25 capable radios.

Once the system has been fully cutover, Leon Valley may expand talk groups on the system. Existing Zetron 4010 consoles can be reused, permitting that the number of talk groups does not surpass capacity on the consoles. The consoles support up to 12 channels, permitting the addition of up to seven additional talk groups.

2011 (Second Half)

During the second half of 2011, L.R. Kimball recommends that Leon Valley secure designated talk groups on the COSA/Bexar County system for each of the two primary police and fire repeater pairs. The talk groups will permit users on the COSA/Bexar County system to monitor and access the primary Leon Valley talk groups, and provide Leon Valley the ability to implement 700/800 MHz radios on the COSA/Bexar County system while maintaining connectivity on the primary Leon Valley channels.

Once repeated talk groups have been established on the COSA/Bexar County system, Leon Valley may begin replacing radios with P25 compliant EDACS radios on the COSA/Bexar County system. Replacement estimates for subscriber radios is approximately 10 percent of the subscriber fleet every six months between 2011 and 2015.

Estimated Cost: \$35,000 (10 radios at \$3,500 each)

2012 (First Half)

During the first half of 2012, L.R. Kimball recommends that Leon Valley continue with subscriber replacements.

Estimated Cost: \$35,000 (10 radios at \$3,500 each)

2012 (Second Half)

During the second half of 2012, L.R. Kimball recommends that Leon Valley reprogram its remaining VHF equipment to operate in the narrowband mode. L.R. Kimball recommends that the reprogramming effort be limited to a period of several days to limit the amount of time users with wideband and narrowband channels will need to communicate. These potential problems can be mitigated by programming subscriber radios in advance of the repeaters with both wideband and narrowband channels. However, this solution requires the restructuring of radio templates and a second programming to remove the wideband channels. L.R. Kimball recommends that Leon Valley test communications between wideband and narrowband programmed radios to determine if communications during the transition will be a problem. If communications are adequate, a limited programming period should be sufficient.

L.R. Kimball recommends that Leon Valley continue radio replacements during this period.

Estimated Cost: \$40,000 (10 radios at \$3,500 each, plus \$5,000 in programming fees)

2013 (First Half)

During the first half of 2013, L.R. Kimball recommends that Leon Valley continue with subscriber replacements.

Estimated Cost: \$35,000 (10 radios at \$3,500 each)

2013 (Second Half)

During the second half of 2013, L.R. Kimball recommends that Leon Valley continue with subscriber replacements.

Estimated Cost: \$35,000 (10 radios at \$3,500 each)

2014 (First Half)

During the first half of 2014, L.R. Kimball recommends that Leon Valley continue with subscriber replacements.

Estimated Cost: \$35,000 (10 radios at \$3,500 each)

2014 (Second Half)

During the second half of 2014, L.R. Kimball recommends that Leon Valley continue with subscriber replacements.

Estimated Cost: \$35,000 (10 radios at \$3,500 each)

2015 (First Half)

During the first half of 2015, L.R. Kimball recommends that Leon Valley continue with subscriber replacements.

Estimated Cost: \$35,000 (10 radios at \$3,500 each)

2015 (Second Half)

During the second half of 2015, L.R. Kimball recommends that Leon Valley replace the remaining radios necessary to fully migrate to the COSA/Bexar County system. Based upon the subscriber units in the field today, 15 additional subscriber radios will require replacement.

Estimated Cost: \$52,500 (15 radios at \$3,500 each)

7.4.3.1.2 Bexar County Fire Alarm

The Fire Alarm system currently utilizes a single simplex base station to dispatch VFD agencies throughout Bexar County. A secondary talkaround channel is used for on-scene operations. The system provides limited coverage from a single site on the Hy-Lions tower. The primary migration deadline associated with the Fire Alarm system is the 2013 narrowbanding deadline. A significant number of radios on the Fire Alarm system are not narrowband capable and must be replaced. L.R. Kimball recommends that new radios purchased to replace wideband radios be 700/800 MHz radios capable of operating on the COSA/Bexar County system.

Migration of the Fire Alarm system primarily requires the replacement of subscriber radios. The Fire Alarm channels are already patched to 800 MHz talk groups on the COSA/Bexar County system, and users on the 800 MHz system communicate with VHF Fire Alarm users on a regular basis. An inventory has not been provided for Fire Alarm radios, therefore recommended replacement cycles have not been provided.

L.R. Kimball acknowledges the limited funding available to VFDs and recognizes that funding to ensure narrowbanding compliance will be a challenge without considering a P25 migration. The infrastructure is in place to support VFD migration to the system as funding for radios is available.

It is recommended that wideband-only radios be replaced with 700/800 MHz P25 radios prior to 2013 and all VHF radios be replaced with 700/800 MHz P25 radios prior to 2016. To support the ongoing VHF operations in Bexar County, COSA and Bexar County plan to implement a four-site VHF overlay to enhance VHF coverage across the county. Each VHF site will serve a specific quadrant of Bexar County. The system will operate in the analog mode and will provide repeater capability to enhance the current system, which only provides simplex capability. The system will include a single countywide channel implemented in a conventional simulcast configuration for dispatch purposes. Each quadrant will utilize two distinct VHF repeater frequencies for tactical communications. Transportable "linker" units will be deployed within each VFD that will serve as a mobile gateway to patch VHF primary channels to 800 MHz talk groups on the trunking system. The linker units will permit unit-to-unit talkaround capability between VHF and 800 MHz users in the event that users are out of range from VHF or 800 MHz coverage. The improved VHF infrastructure will replace local fire repeaters used by some of the FDs within Bexar County for tactical operations.

To quantify funding estimates, 1,000 radios are estimated to require replacement in order to operate on the COSA/Bexar County system. It is estimated that approximately 12 VHF repeaters will be needed in a conventional simulcast configuration for the VHF overlay. Reprogramming efforts will be necessary for all VHF radios to meet the narrowbanding deadline.

The following sections outline L.R. Kimball's recommended upgrade schedule for the Fire Alarm system:

2011

L.R. Kimball recommends that users on the Bexar County Fire Alarm system continue to replace wideband radios with 800 MHz trunking radios that will support both EDACS and P25 operation. L.R. Kimball recommends that Bexar County explore site options for the VHF overlap and begin deploying additional linker units following their successful test with the Bulverde FD. Frequencies must be identified for use in the regional system.

L.R. Kimball recommends that Bexar County Fire Alarm users target the replacement of half of the existing wideband only radios during 2011. It is estimated that this will account for approximately 150 radios. Agencies implementing both VHF and 800 MHz subscriber radios simultaneously should be assigned a linker gateway unit.

2012

L.R. Kimball recommends that Bexar County procure and deploy the VHF infrastructure enhancements during 2012. Any remaining wideband radios must be replaced to comply with the narrowbanding deadline. Reprogramming for the subscriber fleet should be targeted during the third quarter of 2012. At this time the new channel plan for the new VHF overlay should be programmed into all VHF subscriber radios. Linker units should be deployed to any remaining VFDs.

2013 - 2015

L.R. Kimball recommends that agencies continue to replace VHF analog radios with 800 MHz P25 capable radios as older analog radios require replacement. 2015 is targeted as the migration date to align with the State's goal; however, 800 MHz migration may take place over an extended period of time if necessary.

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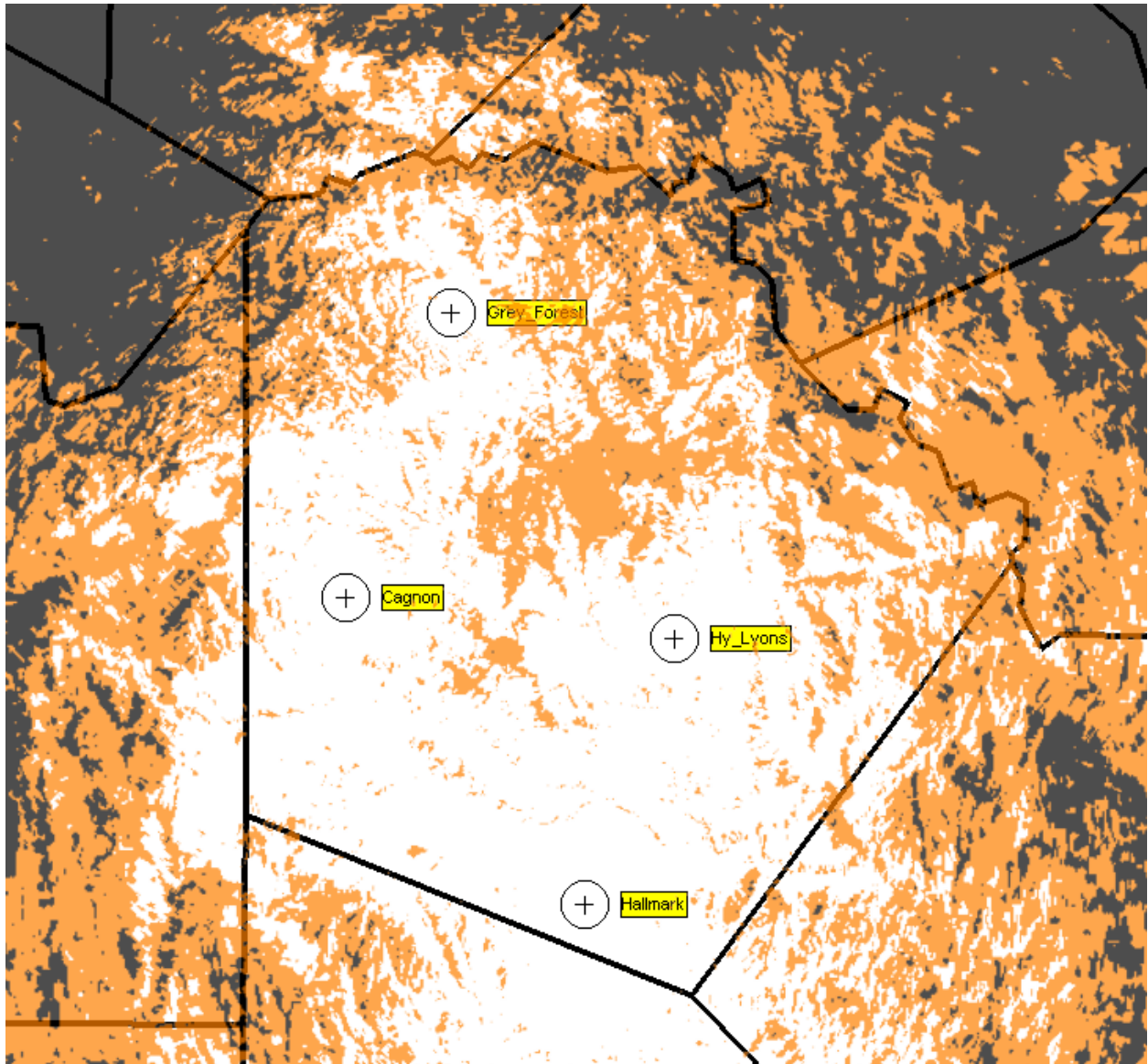


Figure 84 – Potential VHF Overlay Design Using Existing Sites

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Table 260 – Bexar County Fire Alarm Cost Estimates

Component	Cost per Unit	Quantity	Cost
Radio Sites	\$110,000	4	\$440,000
Voting Equipment	\$50,000	1	\$50,000
Radio Programming	\$50	1,000	\$50,000
Subscriber Equipment	\$3,500	1,000	\$3,500,000
Linker Units	\$10,000	20	\$200,000
Training	\$10,000	1	\$10,000
Total			\$4,250,000
Ongoing Costs	\$216	1,000	\$216,000 / year
Ongoing Costs			\$216,000 / year

7.4.3.2 COSA/Bexar County P25 Upgrade

There are plans for the COSA/Bexar County system to eventually migrate to a P25 platform; however, a schedule and funding for the transition have not yet been defined. Subscriber replacements are underway for aging equipment. New radios that have been purchased are capable of P25 operation, and will be available for use once the system is upgraded.

Plans are in place for a 700 MHz P25 overlay to support interoperability throughout the evacuation corridor between Houston and San Antonio. The overlay will provide 700 MHz coverage at the five central locations utilized on the 800 MHz system within the downtown San Antonio area. Two VIDA switches have been purchased for use on the overlay system. The VIDA switches will support migration of the primary system.

The P25 upgrade of the primary system will replace the current system, reusing the existing radio sites and backhaul network. An additional radio site is recommended in the northwest portion of the county to fill coverage gaps. It is recommended that new radio sites be implemented in a simulcast configuration with neighboring radio sites to provide channel capacity to accommodate system expansion. It is recommended that the Live Oak system be tied into the COSA/Bexar County system and be upgraded to P25 along with the primary system. Additional details regarding the Live Oak system are discussed in the following section. To support additional coverage, four additional radio sites are recommended. Two sites will enhance coverage in the northern portion of Bexar County and in the Helotes area. One radio site will expand coverage in the Live Oak area eastward toward Schertz. The last site will be located in the southern portion of the county in the University of Texas area.

San Antonio and Bexar County plan to implement a microwave network connecting the five primary radio sites in the San Antonio area. The network is desired to provide backup connectivity to the SONET. L.R. Kimball recommends that the microwave network be targeted during the P25 implementation.

The recommended migration strategy for the primary system to P25 includes replacing aging subscribers over the next five years. Typical subscriber replacement cycles are between five and seven years. All new radio purchases over the last several years have been P25 capable. Acquiring subscriber radios over the next five years should

permit radio replacement consistent with typical replacement schedules. New subscriber radios must be Phase II upgradeable to support 700 MHz operation after 2017. Infrastructure replacement is targeted for 2015; approximately 11 years after users were migrated to the current EDACS system.

The recommended strategy for hardware cutover includes first tying existing EDACS radio sites to the VIDA switch. All talk groups on the EDACS system will be interconnected with talk groups on the P25 system. Radio equipment will be installed in parallel to the existing repeater systems and tied to the backhaul network. Once all equipment has been installed, channels will be switched to the P25 system one at a time. The interconnected talk groups will provide seamless communication between the systems to permit a migration with uninterrupted radio service. Once all channels have been cut over, the legacy equipment may be decommissioned. Subscriber radios will require reprogramming to operate correctly on the new system.

Existing MASTR III repeater systems have the capability to operate in a P25 Phase I mode. Reusing MASTR III base stations will require upgrades to existing repeaters, but will be less expensive than the replacement of all repeater systems. However, MASTR III base stations will be 11 years old at the recommended time for system replacement, and will be approaching the recommended replacement period. Costs will likely be less in the long run to purchase new repeater systems capable of operating in the Phase II mode. P25 Phase II is a requirement for the 700 MHz portion of the system, but not necessary for the 800 MHz portion of the system. The primary benefit of TDMA is improved channel capacity; however, channel capacity is not a concern for the system based on present loading. Fixed infrastructure has been priced to support TDMA operation.

The following table summarizes details regarding the recommended system for COSA/Bexar County:

Table 261 – COSA/Bexar County Radio System Details

Channel	Description
Number of Radio Sites in System:	17
Number of Channels in System:	Approximately 130 (Mixed simulcast and multi-cast)
Frequency Band:	700/800
Trunking or Conventional:	Trunking
Simulcast (Yes or No)	Yes
Technology (NB analog, P25, etc)	P25 Phase II
Coverage Requirement	95% Indoor Portable at hip-level
Number of Console Positions:	Approximately 60
Number of subscriber units on system:	Approximately 12,100 (including Live Oak users)
System Reliability	99.999%
Encryption	Supported
Telephone Interconnect	No
Private Call	Yes
Growth Flexibility	Coverage and Capacity Flexible through addition of radio sites or channels
Automatic Vehicle Location	No

Channel	Description
Emergency Features	Silent Emergency, Call Interrupt, Emergency Alert
Specialized Equipment	Mobile Gateway, console patching,
Equipment Standardization	P25 capable. Vendor/model selection variable. Harris equipment necessary until legacy EDACS system is decommissioned.
Channel Scan	Yes
Unit ID	Yes
Improved Audio Quality	Digital Audio Quality Using Enhanced Full Rate Vocoder
New Equipment	Analog subscribers will be replaced with P25 subscribers. Core infrastructure will require replacement to support an eventual upgrade to P25 Phase II operation.
Paging and Alert Systems	Maintained in analog mode on VHF channel

Table 262 – COSA/Bexar County Cost Estimates

Component	Cost per Unit	Quantity	Cost
Radio Sites	\$1,000,000	17	\$17,000,000
Consoles	\$60,000	60	\$3,600,000
Microwave	\$150,000	5	\$750,000
Services (e.g., installation, engineering and project management)	30% of infrastructure cost		\$6,405,000
Contingency	10% of infrastructure cost		\$2,135,000
Radio Site Construction and Development	\$500,000	4	\$2,000,000
VIDA Core Integration	\$1,000,000	1	\$1,000,000
Subscriber Equipment	\$3,500	11,100	\$38,850,000
LTE Implementation	\$24,000,000	1	\$24,000,000
Total			\$95,740,000
System Maintenance (minus subscriber fees)	\$1,347,250		\$1,347,250 / year
Revenue - Subscriber Fees (non-city/county/VFD system users)	\$216	2,100	\$453,600 / year
Ongoing Costs			\$893,650 / year

There are several key milestones that must be considered when implementing the COSA/Bexar County system. These include:

End of 2015—The end of 2015 has been targeted as the completion date for the implementation of P25 systems. This migration strategy plan aligns with that goal.

End of 2017—The FCC requires that systems utilizing 700 MHz channels meet a spectrum efficiency requirement of one voice path per 6.25 kHz of spectrum. To meet this requirement, systems utilizing 700 MHz channels must implement P25 Phase II solutions.

2011

L.R. Kimball understands the 700 MHz overlay on the COSA/Bexar County system is scheduled for installation during 2011. L.R. Kimball recommends that COSA and Bexar County pursue options for obtaining 700 MHz spectrum to support operations on the system. Original plans for the system were to utilize State-assigned 700 MHz spectrum; however, it has been indicated that local 700 MHz channels will be required. A 700 MHz plan has not yet been developed for public safety Region 53, which makes it difficult to acquire local 700 MHz channels. Bexar County assigned channels in CAPRAD can be assigned on a temporary basis through a special temporary authorization (STA) request to the FCC. L.R. Kimball recommends that COSA and Bexar County pursue an STA license for local 700 MHz channels and initiate the process to develop a 700 MHz plan for Region 53.

Because COSA/Bexar County users will not utilize the 700 MHz system for primary operations, system installation should not interrupt primary system operations unless radio site components will be shared by both systems. To interconnect the systems, L.R. Kimball recommends that talk groups be assigned on the EDACS system to connect with talk groups on the 700 MHz system. A gateway connection will be necessary to interconnect the systems until the EDACS radio sites are cutover to the VIDA core.

L.R. Kimball recommends that agencies on the COSA/Bexar County system continue to replace aging subscribers with P25 capable subscribers.

Costs associated with the 700 MHz overlay have already been accounted for and are not reflected in the cost estimate.

Estimated Cost: \$7,770,000 (2,220 radios at \$3,500 each)

2012

During 2012, L.R. Kimball recommends that COSA/Bexar County integrate the existing EDACS sites with the VIDA core. Integration of the systems will provide for a more seamless cutover to P25 operation, permit a more seamless integration of the Live Oak system, permit seamless operation between the EDACS radio sites and the 700 MHz overlap, and permit seamless roaming between the LCRA 700 MHz P25 system and the COSA/Bexar County system. Individual radio sites will experience down periods while switching operations to the new system core.

P25 operation on the LCRA 700 MHz system is targeted for several AACOG member agencies during 2012. Plans were indicated to integrate the LCRA and COSA/Bexar County system cores to permit roaming between the two systems. L.R. Kimball recommends that roaming features be established in 2012 to permit P25 users on the LCRA system to roam onto the COSA/Bexar County 700 MHz overlay, and COSA/Bexar County users with P25 radios to roam throughout the LCRA overlay.

Costs associated with the integration of systems on the VIDA core are based primarily on services needed to integrate the system, software upgrades, and network interface hardware. Exact costs for this phase are unknown. The listed price is intended to provide a rough order of magnitude for the services listed.

Subscriber replacements should continue in 2012.

Estimated Cost: \$8,770,000 (2,220 radios at \$3,500 each, plus \$1,000,000 for system integration on the VIDA core)

2013

During 2013, L.R. Kimball recommends that COSA/Bexar County continue to proceed with subscriber replacements for aging equipment.

Estimated Cost: \$7,770,000 (2,220 radios at \$3,500 each)

2014

During 2014, L.R. Kimball recommends that COSA/Bexar County pursue a contract with Harris to upgrade the EDACS system to P25 during 2015. The system should provide Phase II compliance to assure 700 MHz spectrum efficiency compliance for the FCC's 2017 deadline, and additional radio sites to improve coverage along the northern Bexar County border a radio site to the south in the University of Texas area, and one site to the east side of Live Oak. Coverage testing should be required to verify system performance at levels equivalent to or better than the current system.

L.R. Kimball recommends that the remaining non-P25 subscribers be replaced and that new radio sites be developed to accommodate the installation of trunking equipment.

Estimated Cost: \$9,770,000 (2,220 radios at \$3,500 each, plus 4 radio sites at \$500,000 per site)

2015 (First Half)

During the first half of 2015, L.R. Kimball recommends that a design review and staging be completed for the P25 system. The design review should include the finalized list of radio sites and equipment. Following the design review, equipment for the system will be ordered. Equipment staging will take place upon receipt of the equipment. The equipment staging would include the construction of the system in a lab environment. Equipment staging should verify system operation in a controlled setting.

Estimated costs for this phase are associated with approximately one-half of the fixed infrastructure costs.

Estimated Cost: \$14,945,000 (one-half of infrastructure costs)

2015 (Second Half)

During the second half of 2015, installation and testing of the system should take place. System installation should be completed in parallel to the existing system. Existing shelters appear to have sufficient space to accommodate additional equipment; however, the vendor(s) must ultimately be responsible for determining space requirements. P25 equipment is significantly smaller than the legacy EDACS equipment and will require less equipment racks within each shelter. Antenna systems and feed lines should be installed in parallel in addition to the radio equipment. Once all equipment has been installed, a selected group of channels should be cut over for testing purposes. The channels will permit coverage testing and the ability to test system affiliations and roaming on the new system. Once testing results have been approved, user groups may begin migrating to the system. Subscriber radios will be

programmed with channels duplicated in radio zones to permit a simplified method to cutover to the new system. Channels will be cut over from system to system one at a time. Talk groups will be configured to operate on both systems to permit communications between users during the migration. Agencies will cut over to the system one at a time, and verify system performance before additional user groups cut over. Upon system cutover with a verified operational period, old talk groups may be removed from the subscribers and EDACS equipment may be decommissioned.

Estimated costs for this phase are associated with approximately one-half of the fixed infrastructure costs.

Estimated Cost: \$14,945,000 (one-half of infrastructure costs)

2016 – 2020

From 2016 to 2020, L.R. Kimball recommends that San Antonio and Bexar County pursue build out of a countywide LTE system. The City has received a waiver for access to 700 MHz broadband spectrum, and has received a quote to build out the LTE infrastructure. The present design will serve approximately 10,000 users.

Estimated Cost: \$24,000,000

Ongoing Costs

Ongoing system costs are associated with approximately 2.5 percent of the system fixed infrastructure cost to cover the system maintenance contract. Maintenance costs have been considered to include both the P25 and LTE systems. Subscriber fees collected from non-COSA/Bexar County users will offset on-going costs for the maintenance contract.

The estimated cost per year for the maintenance contract is \$1,347,250. It is estimated that subscriber fees will ultimately be collected from approximately 2,100 subscriber units, generating yearly revenue of \$453,600. This leaves a recurring maintenance balance of approximately \$893,650.

Estimated Cost: \$915,250

Cost Breakdown by Year

The following table breaks down the system cost on a year-by-year basis.

Table 263 – COSA/Bexar County Cost Breakdown by Year

Year	Amount	Description
2011	\$7,770,000	Subscriber replacements
2012	\$8,770,000	Subscriber replacements and system integration with VIDA core
2013	\$7,770,000	Subscriber replacements
2014	\$9,770,000	Subscriber replacements and new site development
2015	\$29,890,000	Fixed infrastructure upgrade with new radio site additions
2016	\$0	System maintenance covered under warranty
2017	\$893,650	Recurring maintenance

Year	Amount	Description
2018	\$24,893,650	Recurring maintenance and LTE Build out
2019	\$893,650	Recurring maintenance
2020	\$893,650	Recurring maintenance
Total Cost 2011-2020	\$91,544,600	

7.4.3.3 Live Oak

The Live Oak system is a single-site EDACS system located in the border area between Bexar and Guadalupe County. While operating on the same proprietary trunking platform and frequency band as the COSA/Bexar County system, users on the systems lack the ability to communicate directly with each other. The problem is the result of user key programming features that are not activated on Live Oak subscriber radios.

To address interoperability between Live Oak and COSA/Bexar County, discussions have been held regarding the implementation of the Live Oak system as a radio site on the COSA/Bexar County system. L.R. Kimball supports this migration.

Combining the two radio systems will require updating Live Oak system subscriber radios to the full-feature sets necessary to operate on the COSA/Bexar County system. Backhaul connectivity will need to be established between the Live Oak radio site and the COSA/Bexar County network. The EDACS switch will need to be updated to support the additional radio site.

The Live Oak system includes ten channels. L.R. Kimball recommends that the system maintain operation with ten channels as a multi-cast site on the COSA/Bexar County system. Users on the Live Oak system reported coverage problems on the east side of the site in Guadalupe County. L.R. Kimball recommends that an additional radio site be added to fill coverage gaps. Channels for the additional radio site can be configured in a simulcast arrangement with the primary Live Oak site.

L.R. Kimball recommends that the Live Oak system be integrated with the COSA/Bexar County system once the system core has been replaced with the VIDA switch. Adding the VIDA switch will simplify the addition and result in fewer costs taken at a loss. L.R. Kimball recommends that the merger take place during 2015 when the COSA/Bexar County infrastructure is updated to P25. To establish interoperability in the interim, gateways are recommended to interconnect the two systems. Subscriber software upgrades will be considerable to add features to allow the programming of COSA/Bexar County talk groups into Live Oak system radios. With the pending P25 migration, subscriber radios on the Live Oak system will need to be replaced. Therefore, L.R. Kimball does not recommend that Live Oak proceed with subscriber upgrades for equipment that will need to be replaced in the coming years.

To enhance interoperability, L.R. Kimball recommends that gateways be established to interconnect the Live Oak and COSA/Bexar County systems. COSA/Bexar County radios are capable of programming Live Oak talk groups, and can thus access the Live Oak system. For Live Oak users entering the COSA/Bexar County coverage area, interoperability can be achieved utilizing the 8CALL and 8TAC conventional repeaters. Unit-to-unit talkaround on the

NPSPAC interoperability channels is an alternative when coverage is insufficient on the conventional stations or the Live Oak system.

The subscriber replacement schedule for Live Oak should coincide with COSA/Bexar County, with subscriber replacements beginning in 2011 and continuing through 2015 until all legacy radios are replaced with P25 capable radios.

Costs associated with migration to the COSA/Bexar County system include infrastructure costs associated with connecting the systems. Subscriber costs have been covered in the COSA/Bexar County section. Costs associated with a radio site addition are included in the COSA/Bexar County section.

Table 264 – Live Oak Cost Estimates

Component	Cost per Unit	Quantity	Cost
System Integration (Microwave, software, installation)	\$300,000	1	\$300,000
Total			\$300,000

2011 - 2014

L.R. Kimball recommends that users on the Live Oak system replace the subscriber fleet with P25 capable subscribers between 2011 and 2014.

L.R. Kimball recommends that control stations and gateways be utilized to provide connectivity between the COSA/Bexar County and Live Oak systems during 2011. L.R. Kimball recommends that control stations and gateways be established to interconnect the Live Oak system with the regional LCRA P25 system during 2012.

Costs associated with this phase include subscriber replacements and are reflected in the COSA/San Antonio section.

2015

L.R. Kimball recommends the Live Oak and COSA/Bexar County systems be merged during 2015 when the COSA/Bexar County system is upgraded to P25. Site equipment on the Live Oak system will need to be replaced for the upgrade. Backhaul connections will need to be made to link the COSA/Bexar County backhaul network with the Live Oak radio site. L.R. Kimball recommends that an additional site be added to extend coverage east of the primary Live Oak site.

Costs associated with this phase include the backhaul connection to the Live Oak site and the integration of the site on the VIDA network. Infrastructure replacement costs and costs for the new radio site are reflected in the COSA/Bexar County section.

Estimated Cost: \$300,000

Cost Breakdown by Year

The following table breaks down the system cost on a year-by-year basis.

Table 265 – Live Oak Cost Breakdown by Year

Year	Amount	Description
2015	\$300,000	System integration
Total Cost	\$3,000,000	

7.4.3.4 Funding Gap

The following table summarizes the estimated funding gap based upon past and present future funding sources identified by Bexar County:

Table 266 – Bexar County Funding Gap

	Amount
Past Expenditures (2006 – 2010)	\$533,400
Future Funding (2011 – 2020)	\$1,243,000
Estimated Costs (2011 – 2020)	\$96,094,600
Total Funding Gap 2011 – 2020	\$94,851,600

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7.4.4 Comal County

As indicated in the baseline systems assessment, there are several underlying operability and interoperability gaps present within Comal County today. To summarize these gaps, the following list has been provided.

Interoperability—Interoperability is limited between the Comal County SO and fire services with New Braunfels and 800 MHz users.

Conventional Architecture—The addition of more transmitters in the conventional architecture will introduce operational difficulties for first responders and dispatchers.

P25 Operation—Law enforcement services have upgraded to P25 conventional, while fire services remain analog. This limits access of fire users to the law enforcement channels if needed for capacity or for a mutual aid event. Plans are underway to upgrade the fire/EMS users to digital P25 once a digital solution for dispatch tones has been developed.

7.4.4.1 Recommended System

Based on the needs of Comal County expressed by system users and determined by L.R. Kimball, it is recommended that the County implement a three-site six-channel VHF P25 simulcast system shared by the County SO and fire services. L.R. Kimball recommends that New Braunfels migrate to the 700 MHz P25 regional system.

The county system will likely utilize the sites currently used by the law enforcement conventional network as the existing system provides adequate coverage as confirmed by propagation analysis. L.R. Kimball recommends a coverage requirement of 95 percent portable outdoor at hip-level. The system will likely involve a shared Harris or Motorola P25 core, although the switching method will ultimately be decided between Comal County and the equipment vendor. L.R. Kimball recommends a competitive procurement to assure competitive pricing, although Comal County may work directly with a vendor of choice if preferred.

The system will provide Comal County seamless coverage and capacity to accommodate all law enforcement and fire services. Capacity will support the addition of public works agencies if desired. The system will allow Comal County to continue to use P25 subscriber radios purchased over the past several years; however, a firmware upgrade is necessary to permit trunking operation on these radios. Comal County repeaters currently in operation may or may not be able to be reused depending on the selected vendor. The system will provide seamless roaming for users anywhere within the county. The trunking system will provide Comal County users “talk groups” which will permit a much greater level of user groups on the system. Specific talk groups will be assigned for each VFD, police and law enforcement dispatch and tactical operations. The number of talk groups is virtually unlimited as long as channel usage does not surpass system capacity. The system will reuse the existing backhaul network used for satellite receivers, permitted that the system provides sufficient bandwidth and reliability to accommodate trunking operation. Current MCC5500 consoles are full featured control station-based consoles that should be sufficient; however, the consoles will not provide direct Internet Protocol (IP) connectivity to the trunking system. The trunking system will provide a number of enhanced features, including heightened security, emergency, and encryption options.

To enhance interoperability with New Braunfels and 800 MHz systems, Comal County consoles will be tied to the 700 MHz P25 regional system. The recommended interface is five control stations to permit the direct link of five Comal County talk groups to talk groups on the LCRA system. One talk group on the P25 regional system will be designated for Comal County interoperability. Incoming interoperability traffic on the 700 MHz regional system will contact dispatchers via the specified Comal County regional talk group. Dispatchers will then patch talk groups on the two systems together as needed. Both the regional system and the Comal County VHF system will provide a countywide coverage footprint providing effective use of the patch.

To enhance interoperability with VHF and 700/800 MHz radios that may not have P25 capability or have the appropriate Comal County systems programmed within their radios, L.R. Kimball recommends that Comal County implement base stations on the VHF and 800 MHz calling channels. The stations will provide a conventional interface that will be monitored at the dispatch center. The stations should be placed at the single tower location within Comal County that provides the best countywide coverage.

The system will reuse existing VHF channels where applicable. However, L.R. Kimball recognizes that even VHF channels operated by Comal County may not be suitable for trunking operation. An analysis is necessary to determine if the currently operated Comal County channels are free from interference and sufficiently spaced to accommodate trunking operation. L.R. Kimball notes that a total of seven VHF repeated channels are currently in use. It is not likely that six of these seven channels will be sufficient to use in a simulcast system, so budgeting is estimated for licensing services to acquire additional VHF spectrum. If sufficient VHF spectrum cannot be acquired, then L.R. Kimball recommends Comal County migrate to the 700 MHz P25 regional system, adding a radio site to enhance coverage.

The following table summarizes recommended talk groups on the system; however, additional talk groups may be implemented as needed.

Table 267 – Comal County System Channels

Channel	Description
Talk Group 1	Law Enforcement Dispatch
Talk Group 2	Sheriff TAC1
Talk Group 3	Sheriff TAC2
Talk Group 4	Fire Dispatch
Talk Group 5	Bracken TAC
Talk Group 6	Bulverde TAC
Talk Group 7	Spring Branch TAC
Talk Group 8	Canyon Lake TAC
Talk Group 9	Comal Constables
Talk Group 10	Garden Ridge PD TAC
Talk Group 11	Bulverde PD TAC
Talk Group 12	Comal County Road and Bridge

The following table summarizes details regarding the recommended system for Comal County:

Table 268 – Comal County Radio System Details

Channel	Description
Number of Radio Sites in System:	3
Number of Channels in System:	6
Frequency Band:	VHF
Trunking or Conventional:	Trunking
Simulcast (Yes or No)	Yes
Technology (NB analog, P25, etc)	P25
Coverage Requirement	95% portable at hip-level
Number of Console Positions:	5
Number of subscriber units on system:	
System Reliability	99.999%
Encryption	Supported
Telephone Interconnect	No
Private Call	Supported
Growth Flexibility	Capacity expansion limited by availability of VHF channels
Automatic Vehicle Location	No
Emergency Features	Silent Emergency, Call Interrupt, Emergency Alert
Specialized Equipment	Mobile Gateway
Equipment Standardization	P25 capable. Vendor/model selection variable.
Channel Scan	Yes
Unit ID	Yes
Improved Audio Quality	Digital Audio Quality Using Enhanced Full Rate Vocoder
New Equipment	Analog subscribers will be replaced with P25 subscribers. Trunking equipment will be added to the radio sites.
Paging and Alert Systems	Maintained in analog mode on separate channel

L.R. Kimball recommends that the city of New Braunfels migrate primary operations to the 700 MHz regional P25 system on the LCRA network. New Braunfels is currently a user on the LCRA EDACS network. Operation on the 700 MHz system will be very similar to operation on the current network. Talk group configurations may be configured to be identical on the 700 MHz system as they currently are on the EDACS system. Key benefits of the 700 MHz system will be the ability to roam anywhere within the AACOG region covered by the P25 system. Because each agency throughout the region will interface with the regional system, New Braunfels should have the capability to communicate with any user group.

The 700 MHz P25 system has already been built out on the primary New Braunfels LCRA tower. 700 MHz equipment has not been installed on the central Comal County radio site that extends coverage to the west of New

Braunfels. Because the 700 MHz system has already been built out on the primary radio site, New Braunfels has the ability to migrate operation to the P25 system at its convenience. L.R. Kimball recommends that New Braunfels migrate to the 700 MHz system when the system has been built out throughout Comal County by the region.

Migration to the 700 MHz system will require the replacement of current subscriber radios and dispatch consoles. L.R. Kimball has targeted a migration to P25 by 2014 before the LCRA EDACS system is decommissioned. L.R. Kimball notes that some of the subscriber radios utilized by New Braunfels are P5300 and M5300 series radios, which are capable of operating on the OpenSky mode. If New Braunfels requires additional time to secure funding beyond 2014, the potential exists for New Braunfels to operate a portion of the subscriber fleet on the OpenSky platform. If New Braunfels chooses this option, New Braunfels talk groups would duplicate their talk groups on both the OpenSky and P25 systems. The systems would be gateway connected by LCRA so that all radio traffic would be repeated on both systems. This setup would permit New Braunfels to operate both 700 MHz and 900 MHz subscribers simultaneously until funding can be secured to upgrade the remaining 900 MHz subscribers to 700 MHz. L.R. Kimball notes that New Braunfels only operates approximately 25 5300 series radios, and that it will not be beneficial for New Braunfels to operate in this mode.

7.4.4.2 Cost Estimate

The cost estimate is based on averages for list prices of the typical components of a system with this design. Specific designs will vary in price. Cost savings may be recognized by reusing existing equipment. This determination will ultimately be made by the selected vendor.

Table 269 – Comal County Cost Estimates

Component	Cost per Unit	Quantity	Cost
Cost per site	\$500,000	3	\$1,500,000
Subscriber Equipment	\$3,500	84	\$294,000
Subscriber Trunking Equipment Upgrades	\$1,000	549	\$549,000
VHF Interoperability Base Station	\$30,000	1	\$30,000
800 MHz Interoperability Base Station	\$30,000	1	\$30,000
Licensing Fees	\$15,000	1	\$15,000
700 MHz Control Stations	\$10,000	5	\$50,000
Total			\$2,358,000
Maintenance Fees	\$40,250 / year		\$40,250 / year
Ongoing Costs			\$40,250 / year

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Table 270 – New Braunfels Cost Estimates

Component	Cost per Unit	Quantity	Cost
Subscriber Replacements	\$3,500	344	\$1,204,000
Consoles	\$60,000	4	\$240,000
Total			\$1,444,000
Subscriber Fees	\$180	344	\$61,920 / year
Ongoing Costs			\$61,920 / year

7.4.4.3 Migration Plan

There are several key milestones that must be considered when implementing the Comal County system. These include:

January 1, 2013— Any remaining equipment operating in a wideband mode must be upgraded to meet narrowbanding compliance prior to January 1, 2013.

End of 2015—The end of 2015 has been targeted as the completion date for the implementation of P25 systems. This migration strategy plan aligns with that goal.

2011

Since a funding source is not immediately available to build out a countywide simulcast trunking system, it is anticipated that 2011 will provide time to identify such a source. This will provide time for the evaluation of the AACOG RICP, which could in turn provide a potential funding source if money is awarded by the state legislature. During this period, L.R. Kimball recommends that Comal County continue to replace wideband and aging analog subscriber equipment with subscribers that will support P25 VHF trunking operation. The user inventory indicated that approximately 84 radios used by Comal County fire services are not P25-capable.

In addition to subscriber replacements, a spectrum assessment effort is needed to determine if existing VHF channels are sufficiently free of interference and sufficiently spaced to accommodate simulcast operation. Currently, seven VHF frequency pairs are licensed by law enforcement and fire services within Comal County. It is likely additional channels will be needed to satisfy the spacing requirements for trunking operation and to facilitate a seamless cutover between the systems. If channels can be identified, these channels need to be licensed at a single location to reserve the channel. Final sites will be licensed following approval by the equipment vendor of the sites selected. Call signs WPKH510 and WPFC267 will be updated with narrowband emissions during this period. Cost estimates are based on the replacement of 84 subscriber radios and on licensing fees.

Estimated Cost: \$309,000 (replacement of 84 subscriber radios and licensing fees)

2012 (First Half)

Once a funding source has been identified, a vendor must be selected to provide the system. L.R. Kimball recommends a form of competitive procurement to assure system costs are minimized. However, Comal County

may choose to procure the system with their vendor of choice. Both Harris and Motorola P25 switches are available in the region that could ultimately be used to control Comal County trunking system.

During this period, it is anticipated that Comal County will identify an equipment vendor and negotiate a contract to build the system. The contract will include a final design, inclusive of site selection, coverage requirements, microwave/backhaul specifications, service/maintenance specifications, schedule, backup power specifications, testing procedures and RF equipment specifications. The process will include the development of a system design that will provide a guaranteed coverage level of 95 percent portable coverage for a subscriber unit at hip-level. L.R. Kimball recommends that consulting services be utilized to assist with the procurement process.

Estimated Cost: \$0

2012 (Second Half)

During the second half of 2012, Comal County will begin installation of the radio system. The first focus of the process will be to assure all subscriber equipment is operating in a narrowband mode to demonstrate compliance with the FCC narrowbanding mandate. By this time all subscriber radios should be narrowbanding capable. Base stations currently operating in the wideband mode will be reprogrammed in the narrowband mode.

During this period, the initial shipment of equipment will be ordered. Site acquisition and development will take place to build out any new radio sites if necessary. Site development will include enhancement of reused Comal County sites. These sites will likely require the installation of the shelters, complete with concrete foundation, pre-fabricated concrete structure, equipment racks, HVAC systems, antenna systems, feed lines, UPS systems, generator, and grounding systems consistent with industry standards. Sites should be constructed to standards such as Motorola R56 or equivalent.

To comply with the TSICP, base stations programmed with the TXLAW2/Inter-city channel will be programmed with VCALL10. Subscriber radios that do not have the narrowband interoperability channels programmed must be re-tuned to include these channels. Installation of the interoperability repeaters will take place during this period.

Costs during this period are anticipated for approximately one-half of the fixed infrastructure costs, including interoperability repeaters and one-half of subscriber upgrade fees.

Estimated cost: \$1,054,500

2013 (First Half)

During the first half of 2013, it is anticipated that staging and installation of the system will take place. Staging should include a complete build out of the radio system infrastructure in a laboratory setting to demonstrate proof of performance. Once performance during staging has been verified by Comal County representatives, the vendor will be permitted to install the equipment at the appropriate tower locations.

Costs during this period are anticipated for approximately one-half of the fixed infrastructure costs, including interoperability repeaters and one-half of subscriber upgrade fees.

Estimated cost: \$1,054,500

2013 (Second Half)

During the second half of 2013, it is anticipated that system testing will take place. System testing will include drive testing to assure that the system provides the coverage levels contractually obligated by the vendor. System testing will include “talk out” and “talk back” audio quality testing, including selected buildings consistent with the vendor contract. System testing will include proof of concept with dispatch console use and all radio features. Once testing has been completed, Comal County will provide an initial acceptance of the system.

Once the system is accepted, Comal County will migrate users to the new system. Cutover will be accomplished one channel at a time. Swing channels, if available, will be used. During the actual cutover, traffic can be routed to operational channels that have not been cut over to the new system. Departments will cut over operations one at a time. Subscriber equipment will remain the same, so cutover is anticipated to be relatively seamless.

Estimated cost: \$0

2014

During 2014, it is anticipated that New Braunfels will transition to the 700 MHz P25 regional system on the LCRA network. Transitioning to the system will consist entirely of replacing subscriber equipment with 700/800 MHz radios that will support P25 Phase II to meet the 2017 700 MHz narrowbanding mandate. Since there are no dual-band 700 and 900 MHz radios, transitioning to the P25 system will require the complete replacement of all subscribers. The transition should align with the regional implementation of the P25 system, and should permit operation prior to the decommissioning of the LCRA EDACS system.

In total there are 343 subscribers on the New Braunfels system. To allow for a seamless migration, New Braunfels talk groups on the 900 MHz EDACS system will be interfaced with equivalent talk groups on the P25 system. This will cause transmitted audio from one system to repeat on the other, allowing for the staged implementation of subscriber equipment. Departments will be cut over one at a time to limit risk during the cutover. Existing dispatch consoles will need to be replaced with Harris Maestro IP consoles.

Costs associated with the migration are attributed to subscriber replacements and dispatch consoles.

Estimated Cost: \$1,444,000

Ongoing Costs

Ongoing costs are attributed to system maintenance on the Comal County trunking system and subscriber fees for New Braunfels. Maintenance costs for the Comal County system are estimated to be 2.5 percent of the fixed infrastructure cost or \$40,250 per year. Estimated subscriber fees for the New Braunfels system are \$15 per radio per month, or \$61,920 per year.

Cost Breakdown by Year

The following table breaks down the system cost on a year-by-year basis.

Table 271 – Comal County Cost Breakdown by Year

Year	Amount	Description
2011	\$309,000	Comal County Fire subscriber replacements and VHF spectrum analysis
2012	\$1,054,500	Site development for Comal County system
2013	\$1,054,500	RF fixed infrastructure installation for Comal County system
2014	\$1,444,000	Subscriber replacements for New Braunfels
2015	\$102,170	Comal and New Braunfels operational costs and maintenance
2016	\$102,170	Comal and New Braunfels operational costs and maintenance
2017	\$102,170	Comal and New Braunfels operational costs and maintenance
2018	\$102,170	Comal and New Braunfels operational costs and maintenance
2019	\$102,170	Comal and New Braunfels operational costs and maintenance
2020	\$102,170	Comal and New Braunfels operational costs and maintenance
Total Cost 2011-2020	\$4,475,020	

7.4.4.4 Funding Gap

The following table summarizes the estimated funding gaps based upon past and present future funding sources identified by Comal County:

Table 272 – Comal County Funding Gap

	Amount
Past Expenditures (2006 – 2010)	\$1,014,618
Future Funding (2011 – 2020)	\$1,940,423
Estimated Costs (2011 – 2020)	\$4,475,020
Total Funding Gap 2011 – 2020	\$2,534,597

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7.4.5 Frio County

As indicated in the baseline systems assessment, there are several underlying operability and interoperability gaps present within Frio County today. To summarize these gaps, the following list has been provided.

Coverage—Coverage is provided for Frio County by a single conventional radio site. User feedback indicated radio coverage on the system is insufficient.

Site Conditions—Radio site conditions are below the industry standard for reliable communications.

Narrowbanding—Much of the Frio County subscriber fleet is not narrowbanding capable. Radio upgrades are needed prior to the narrowbanding cutover January 1, 2013.

Capacity—Law enforcement and fire/EMS are limited to one channel each. This capacity is insufficient when multiple incidents occur simultaneously.

7.4.5.1 Recommended System

Based on the needs of Frio County expressed by system users and determined by L.R. Kimball, it is recommended that the County implement a single site VHF P25 conventional system with a long-term goal of migrating to the 700 MHz P25 regional system. The system will address the primary limitations with the current system including coverage and capacity. The system will permit the reuse of recently purchased P25 VHF subscriber radios, and allow for the purchase of less expensive conventional P25 radios.

A total of four channels are recommended on the system; providing two channels for law enforcement and two channels for county fire operations. Coverage permitting, the radio site co-locate with the planned location for the regional 700 MHz system. The reuse of radio sites will permit the build out of reliable facilities with adequate radio shelters, backup power systems, and grounding. Tower lease fees will ultimately be covered by the regional system without placing a tower lease burden on Frio County.

System implementation is targeted to begin in 2012 to satisfy the narrowbanding requirement. The current MSF5000 repeaters and current wideband subscriber radios must be replaced by 2012 to comply with the narrowbanding deadline. Migrating to the system will require the upgrade of facilities at the primary radio site to include an adequate shelter, generator, UPS, HVAC, and grounding systems.

To address interoperability, L.R. Kimball recommends that Frio County program the primary channels of neighboring VHF jurisdictions into their subscriber radios. Console replacements are recommended to permit additional channel capacity and console patching capabilities. Interoperability base stations should be implemented in the VHF and 800 MHz frequency bands to permit incoming VHF or 800 MHz users a means to communicate with Frio County dispatchers. Console patching will permit dispatchers the ability to connect Frio County end users with responding interoperability traffic. L.R. Kimball recommends that Frio County implement three 700 MHz control stations to connect with the regional 700 MHz system once it has been expanded into Frio County.

In the long-term, it is recommended that the County migrate to the regional P25 700 MHz system. The system will provide enhanced coverage throughout the county, allowing seamless roaming between radio sites. The system will, as proposed by LCRA, provide 98 percent mobile coverage and 80 percent portable coverage.

The system will provide Frio County seamless coverage and capacity to accommodate all law enforcement and fire services. Capacity will support the addition of public works agencies if desired; however, additional fees will likely be incurred for public works users. Through a phased implementation, the system will permit Frio County to continue to use recently purchased VHF P25 subscribers, phasing the system over to 700 MHz over a period of approximately ten years.

The system will provide seamless roaming for users anywhere within the county. The trunking system will provide Frio users “talk groups” that will permit a much greater level of user groups on the system. Specific talk groups will be assigned for each VFD, police and law enforcement dispatch and tactical operations. The number of talk groups is virtually unlimited as long as channel usage does not surpass system capacity.

All fixed infrastructure on the P25 portion of the system will be maintained by LCRA. Existing VHF systems must be maintained to support reliable communications until all VHF equipment has been replaced.

The following table summarizes the channels as they will appear in the system:

Table 273 – Frio County System Channels

Channel	Description
Channel 1	Law Enforcement Dispatch
Channel 2	Law Enforcement Tactical
Channel 3	Fire/EMS Dispatch
Channel 4	Fire/EMS Tactical

The following table summarizes details regarding the recommended system for Frio County:

Table 274 – Frio County Radio System Details

Channel	Description
Number of Radio Sites in System:	1
Number of Channels in System:	4
Frequency Band:	VGF
Trunking or Conventional:	Conventional
Simulcast (Yes or No)	No
Technology (NB analog, P25, etc)	P25 Phase I Conventional
Coverage Requirement	95% Mobile
Number of Console Positions:	2

Channel	Description
Number of subscriber units on system:	Approximately 170
System Reliability	99.999%
Encryption	Supported
Telephone Interconnect	No
Private Call	No
Growth Flexibility	Limited by frequency availability
Automatic Vehicle Location	No
Emergency Features	
Specialized Equipment	Mobile gateway.
Equipment Standardization	
Channel Scan	Yes
Unit ID	Yes
Improved Audio Quality	Digital audio quality
New Equipment	VHF P25 conventional subscribers needed by all agencies except SO
Paging and Alert Systems	Yes, maintained in VHF analog mode

7.4.5.2 Cost Estimate

The cost estimate is based on averages for list prices of the typical components of a system with this design. Specific designs will vary in price. Cost savings may be recognized by reusing existing equipment. This determination will ultimately be made by the selected vendor.

Table 275 – Frio County Cost Estimates

Component	Cost per Unit	Quantity	Cost
Consoles	\$60,000	2	\$120,000
Repeater Purchases	\$30,000	4	\$120,000
VHF Subscriber Upgrades	\$2,000	144	\$288,000
Radio Site Enhancements	\$150,000	1	\$150,000
VHF Interoperability Base Station	\$30,000	1	\$30,000
800 MHz Interoperability Base Station	\$30,000	1	\$30,000
700 MHz Control Station	\$30,000	1	\$30,000
700 MHz Subscriber Equipment	\$3,500	170	\$595,000
Licensing Fees	\$2,000	1	\$2,000
Total			\$1,365,000
System maintenance	\$7,500	1	\$7,500 / year
Subscriber Fees (Following 700 MHz migration)	\$180	170	\$30,600 / year
Ongoing Costs			\$38,100 / year

7.4.5.3 Migration Plan

There are several key milestones that must be considered for migration to the P25 700 MHz regional system. These include:

January 1, 2013—Frio County operates numerous radios that will not meet the narrowbanding deadline, and must be fully operational on the system by January 1, 2013. The purpose is to avoid spending money on both narrowbanding and 700 MHz radios.

End of 2015—While P25 compliance is targeted as a vision more so than a requirement in the SCIP, the end of 2015 has been targeted as the completion date for the regional system. This will align with requirements to meet P25 requirements in the TSICP, which require interoperability channels to operate in the P25 conventional mode by January 1, 2015.

2011

The VHF infrastructure will operate in a similar fashion to the present conventional wideband system. L.R. Kimball recommends that Frio County continue to replace wideband VHF subscriber radios with P25 conventional VHF radios. Newly deployed radios should be programmed with the appropriate interoperability channels and primary dispatch channels of neighboring jurisdictions.

Two additional VHF repeater pairs will need to be licensed by Frio County for use in the system. The licensing analysis should take place in 2011 for implementation of the channels in 2012.

Estimated costs are associated with the replacement of approximately half of the remaining analog radios, or 72 radios and licensing fees.

Estimated Cost: \$146,000

2012

L.R. Kimball recommends that Frio County implement the remainder of the system infrastructure in 2012. The P25 repeaters will replace the existing MSF5000 repeaters that are not narrowband capable. Radio site enhancements should be planned during the first half of 2012 with the plan that infrastructure will be installed during the second half of 2012. The remaining analog subscriber radios should be replaced during the first half of 2012 so that all subscriber radios will be capable of operating on the new system once it has been installed.

To permit a seamless cutover, all newly deployed subscriber radios should be programmed with both the old and new frequency assignments. At the time of system cutover, channels will be cut from the old repeaters to the new repeaters one at a time. Because a new channel will be licensed for law enforcement and fire/EMS operation, system cutover should involve a straight switch from the old channels to the new channels. After cutover has been completed, the old repeaters may be decommissioned and the new channels will be activated. Radio users will simply have to change channels on their subscribers to access the new frequency assignments.

Interoperability base stations and consoles should be targeted during 2012.

Estimated costs are associated with the remaining system costs for Frio County, including repeater replacements, subscriber radios, interoperability repeaters, and dispatch consoles.

Estimated Cost: \$594,000

2013 - 2015

L.R. Kimball recommends that Frio County implement 700 MHz control stations to interface with the regional P25 system once the system has been expanded into Frio County.

Estimated Cost: \$30,000

2016 – 2020

L.R. Kimball recommends that Frio County explore migration to the regional 700 MHz system once the system has been installed within Frio County. Before committing to a migration, Frio County must verify that the regional system provides sufficient coverage for Frio County users. Migration to the regional system will require the replacement of all VHF subscriber radios.

Estimated Cost: \$595,000

Ongoing Costs

Ongoing costs are anticipated to be approximately 2.5 percent of infrastructure costs, or \$7,500 / year. Ongoing costs following a migration to the regional system are anticipated to be based upon subscriber fees for 170 radios, or \$30,600 / year.

Cost Breakdown by Year

The following table breaks down the system cost on a year-by-year basis.

Table 276 – Frio County Cost Breakdown by Year

Year	Amount	Description
2011	\$146,000	Subscriber replacements
2012	\$594,000	Subscriber replacements and infrastructure costs
2013	0	Equipment under warranty
2014	\$7,500	Equipment maintenance
2015	\$37,500	Equipment maintenance and 700 MHz connectivity
2016	\$7,500	Equipment maintenance
2017	\$7,500	Equipment maintenance
2018	\$7,500	Equipment maintenance
2019	\$7,500	Equipment maintenance
2020	\$595,000	700 MHz cutover
Total Cost 2011-2020	\$1,410,000	

7.4.5.4 Funding Gap

The following table summarizes the estimated funding gap based upon past and present future funding sources identified by Frio County:

Table 277 – Frio County Funding Gap

	Amount
Past Expenditures (2006 – 2010)	\$115,000
Future Funding (2011 – 2020)	\$2,000,000
Estimated Costs (2011 – 2020)	\$1,410,000
Total Funding Gap 2011 – 2020	\$0

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7.4.6 Gillespie County

As indicated in the baseline systems assessment, there are several underlying operability and interoperability gaps present within Gillespie County today. To summarize these gaps, the following list has been provided.

Interoperability—Interoperability is limited between the Gillespie County fire agencies and Gillespie County SO and EMS who utilize the LCRA 900 MHz EDACS system, as well as neighboring counties that are using various other spectrum and technologies, such as COSA/Bexar County's trunked 800 MHz EDACS system and Comal County, which operates on LCRA's 900 MHz EDACS system.

Conventional Architecture—Adding additional transmitters in the conventional architecture will introduce operational difficulties for first responders and dispatchers.

P25 Operation—While a partial migration to P25 has taken place within Gillespie County, there are still agencies and radios using wideband analog technology.

7.4.6.1 Recommended System

Based on the needs of Gillespie County expressed by system users and determined by L.R. Kimball, it is recommended that the county migrate to the regional P25 700 MHz LCRA system. The system will provide enhanced coverage throughout the county, allowing seamless roaming between radio sites. As proposed by LCRA, the system will provide 94 percent mobile coverage and 72 percent portable coverage.

The system will provide Gillespie County seamless coverage and capacity to accommodate all law enforcement and fire services. Capacity will support the addition of public works agencies if desired; however, additional fees will likely be incurred for public works users. Through a phased implementation, the system will permit Gillespie County to continue to use recently purchased VHF P25 subscribers, phasing the system over to 700 MHz over a period of approximately five years.

The system will provide seamless roaming for users anywhere within the county. The trunking system will provide Gillespie County users "talk groups," which will permit a much greater level of user groups on the system. Specific talk groups will be assigned for each VFD, police and law enforcement dispatch and tactical operations. The number of talk groups is virtually unlimited, as long as channel usage does not surpass system capacity.

All fixed infrastructure on the P25 portion of the system will be maintained by LCRA. Existing VHF systems must be maintained to support reliable communications until all VHF equipment has been replaced. Following system cutover, VHF equipment on VCALL10 will be maintained for interoperability purposes. L.R. Kimball recommends that Gillespie County implement an 800 MHz interoperability repeater on the calling channel to permit communication with 800 MHz users who may not have radios properly programmed to access the regional system.

L.R. Kimball recommends that the existing dispatch consoles be replaced to accommodate increased functionality and channel capacity.

The migration strategy will require tying existing VHF systems into the LCRA system and connecting Gillespie County talk groups with each primary VHF channel. This will allow users to operate on both the VHF and 700 MHz band for an extended period of time until the point all VHF subscribers have been phased out.

To satisfy the narrowbanding deadline, VHF equipment operating in the wideband mode will be reprogrammed for narrowband operation. Any remaining wideband radios should be replaced prior to the narrowbanding deadline.

The following table summarizes the channels as they will appear in the system:

Table 278 – Gillespie County System Channels

Channel	Description
Channel 1	Fire Dispatch
Channel 2	EMS Dispatch/TAC
Channel 3	SWVFD TAC
Channel 4	WCVFD TAC
Channel 5	DOSSVFD TAC
Channel 6	HVFD TAC
Channel 7	FBG PD Dispatch
Channel 8	FBG PD TAC
Channel 9	FBG SO Dispatch
Channel 10	FBG SO TAC

The following table summarizes details regarding the recommended system for Gillespie County:

Table 279 – Gillespie County Radio System Details

Channel	Description
Number of Radio Sites in System:	4 (LCRA sites in area)
Number of Channels in System:	20+ (approximately 5/site)
Frequency Band:	700 MHz
Trunking or Conventional:	Trunking
Simulcast (Yes or No)	No
Technology (NB analog, P25, etc)	P25
Coverage Requirement	94% mobile 74% portable (today)
Number of Console Positions:	3 (1 Fire/EMS, 2 law enforcement)
Number of subscriber units on system:	Approximately 300
System Reliability	99.999%
Encryption	Supported
Telephone Interconnect	Supported

Channel	Description
Private Call	Supported
Growth Flexibility	Additional Coverage and Capacity through increased channels and radio sites
Automatic Vehicle Location	Not initially supported
Emergency Features	Emergency Alert
Specialized Equipment	Mobile gateway
Equipment Standardization	P25 700 MHz Phase I Trunking and Phase II Upgradeable
Channel Scan	Yes
Unit ID	Yes
Improved Audio Quality	P25 Digital with AMBE+2 Vocoder
New Equipment	Infrastructure installed with regional system. Replacement of all subscriber radios and consoles required.
Paging and Alert Systems	Maintained on VHF

7.4.6.2 Cost Estimate

Radios currently in use within Gillespie County and Fredericksburg PD are Harris P5350 portables, Harris M5300 mobiles, and Ericsson LPE 200 portables and mobiles. While the P5350 and M5300 can be upgraded to P25 operation, they cannot operate in the 700 MHz band. As a result, these radios are unusable on the new LCRA 700 MHz overlay and will need to be replaced.

Table 280 – Gillespie County Cost Estimates

Component	Cost per Unit	Quantity	Cost
Consoles	\$60,000	3	\$180,000
800 MHz Interoperability Repeater	\$30,000	1	\$30,000
VHF Interoperability Repeater	\$30,000	1	\$30,000
Narrowbanding Upgrades	\$10,000	1	\$10,000
Subscriber Equipment	\$3,500	380	\$1,330,000
Total			\$1,580,000
Subscriber Fees	\$180	380	\$68,400 / year
Ongoing Costs			\$68,400 / year

7.4.6.3 Migration Plan

There are several key milestones that must be considered when implementing the Gillespie County system. These include:

January 1, 2013—L.R. Kimball was unable to gather sufficient information to determine the level of effort needed to narrowband the existing Gillespie County fire/EMS system. Any equipment operating that is not capable of narrowband operation must be replaced; any equipment operating in the wideband mode must be reprogrammed.

End of 2014—Since the LCRA system is migrating to OpenSky, users currently on the LCRA need to have a P25 option before operations cease on the EDACS system.

End of 2015—While P25 compliance is targeted as a vision more so than a requirement in the SCIP, the end of 2015 has been targeted as the completion date for the regional system. This will align with requirements to meet P25 requirements in the TSICP, which require interoperability channels to operate in the P25 conventional mode by January 1, 2015.

2011

During 2011, L.R. Kimball recommends that Gillespie County install an 800 MHz repeater on the 8CALL90 channel at the LCRA Fredericksburg site. The repeater should be integrated with the Fredericksburg SO dispatch console to provide a means for connectivity to 800 MHz users. The dispatcher may then patch the channel to a primary operational talk group or channel used within Gillespie County. While coverage from the single repeater will not span the entire county, the footprint will provide coverage in the Fredericksburg area. The 700 MHz P25 overlay will serve as the primary inter-region interoperability backbone; however, the potential exists for 800 MHz radios to respond to Gillespie County that are not properly programmed to operate on the LCRA system. The conventional repeater will provide connectivity for any such 800 MHz users.

L.R. Kimball recommends that Gillespie County fire/EMS users test coverage provided by the current LCRA 900 MHz EDACS system, and determine if system coverage will be adequate for primary operations. Radio coverage for 700 MHz operation should be nearly equivalent to 900 MHz operation. If coverage is insufficient, additional radio sites will likely be necessary, which would dramatically increase system costs.

Estimated Cost: \$60,000 (VHF and 800 MHz interoperability base stations)

2012

During 2012, L.R. Kimball recommends that Gillespie County take necessary actions to narrowband VHF systems. Narrowbanding modifications are assumed to include the reprogramming of subscriber units and base stations to operate in the narrowband mode. Call sign WNLN713 will require the addition of narrowband emissions to demonstrate compliance with the FCC narrowbanding mandate. The reprogramming of VHF systems should be conducted expeditiously to limit the period that wideband and narrowband units will require direct communication.

L.R. Kimball recommends that the current Zetron 4010 consoles utilized by Gillespie County be replaced with full-featured consoles to provide improved channel capacity, display unit ID and status messages, and provide channel patching capabilities. The new consoles will support additional features provided by the P25 trunking system once installed.

Estimated Cost: \$190,000 (replacement of three consoles at \$60,000 per console, plus reprogramming 200 radios at \$50 per radio)

2013

During 2013, L.R. Kimball recommends that Gillespie County prepare for migration to the 700 MHz P25 LCRA system. Preparations include developing fleet maps, and establishing interoperability procedures on the system. Implementation of the 700 MHz system is slated to take place within Gillespie County during 2012. Following implementation Gillespie County may begin cutting users over to the system at its leisure.

No costs are estimated during 2013.

Estimated Cost: \$0

2014

L.R. Kimball recommends that Gillespie County perform the primary system migration during 2014. New subscriber radios will be needed to replace all existing VHF and 900 MHz radios currently in use by Gillespie County fire/EMS, Gillespie County SO, and the city of Fredericksburg. This is approximately 380 subscriber radios, including control stations. Dispatch consoles will need to be interfaced with talk groups on the 700 MHz system. Testing of the system will need to be performed before users cut over to the system. Once it is determined that the system meets operational requirements, user groups may begin cutting over to the new system.

Training will be necessary to provide users an understanding of trunking system operation, new radio usage, and revised fleet mapping. During the transition, talk groups on the LCRA EDACS system will be interfaced with talk groups on the 700 MHz system so that repeated traffic will appear on both systems. This will permit user migration with minimal interruption to radio service. Radio users will carry both VHF and 700 MHz radio during the transition until all users have cutover and determined that the system is functioning correctly.

Subscriber fees will continue to be incurred for the Gillespie County SO and Fredericksburg. Additional subscriber fees will be incurred for Gillespie County fire/EMS users.

Following the transition, L.R. Kimball recommends that VHF repeaters be maintained at the three primary radio sites for paging purposes. VHF operations should be maintained on the VCALL10 channel to assure ongoing interoperability with incoming VHF users. L.R. Kimball recommends that paging operations continue on VHF.

Should funding be unavailable for a complete migration, VHF systems may be cut over to the 700 MHz system over an extended period of time. To permit the extended migration, L.R. Kimball recommends that existing VHF channels be permanently patched to 700 MHz talk groups. The patch will permit communication between VHF and 700 MHz users, providing that all users are within the overlapping coverage area of the systems.

Costs associated with this phase include the replacement of approximately 380 subscriber radios.

Estimated cost: \$1,330,000 (380 radios at \$3,500 per radio)

Ongoing Costs

L.R. Kimball estimates that ongoing costs will be primarily associated with subscriber fees on the LCRA system. Estimated subscriber fees are for a total of 380 radios at \$15 per radio per month, for a total of \$68,400 per year.

Cost Breakdown by Year

The following table breaks down the system cost on a year-by-year basis.

Table 281 – Gillespie County Cost Breakdown by Year

Year	Amount	Description
2011	\$60,000	Interoperability base stations
2012	\$190,000	Console replacement and narrowbanding
2013	0	Migration planning
2014	\$1,330,000	Subscriber Replacements
2015	\$68,400	Subscriber Fees
2016	\$68,400	Subscriber Fees
2017	\$68,400	Subscriber Fees
2018	\$68,400	Subscriber Fees
2019	\$68,400	Subscriber Fees
2020	\$68,400	Subscriber Fees
Total Cost 2011-2020	\$1,990,400	

7.4.6.4 Funding Gap

The following table summarizes the estimated funding gap based upon past and present future funding sources identified by Gillespie County:

Table 282 – Gillespie County Funding Gap

	Amount
Past Expenditures (2006 – 2010)	\$53,275
Future Funding (2011 – 2020)	\$100,000
Estimated Costs (2011 – 2020)	\$1,990,400
Total Funding Gap 2011 – 2020	\$1,890,400

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7.4.7 Guadalupe County

As indicated in the baseline systems assessment, there are several underlying operability and interoperability gaps present within Guadalupe County today. To summarize these gaps, the following list has been provided.

Conventional Architecture—The current Guadalupe County system utilizes a conventional architecture that creates operational challenges for radio system users.

Non-public safety-grade Radios—Radios operated by Guadalupe County are narrowband compliant, but are not built to public safety standards for reliability and durability.

Coverage—Coverage problems were reported by Guadalupe County.

Interference—Interference problems were reported by Guadalupe County.

Interoperability—Numerous interoperability gaps were expressed by Guadalupe County and Seguin. Gaps are the result of disparate frequency band utilization and a lack of shared channels.

7.4.7.1 Recommended System

Guadalupe County indicated plans to migrate to a countywide Kenwood NEXEDGE system. The system will operate on the proprietary Kenwood trunking platform. L.R. Kimball does not favor the implementation of NEXEDGE systems as a public safety solution, primarily due to the lack of P25 capability, the use of non-public safety-grade radios, and the untested nature of NEXEDGE trunking capabilities. Interference problems experienced on the present conventional system could impact operation on the trunking system, and should be explored prior installation of the system. License modifications will be necessary to reshuffle VHF spectrum where necessary. L.R. Kimball recommends that the NEXEDGE system include permanent gateways to interface with the co-located and neighboring systems. Gateway connections should be established between talk groups on the Guadalupe County, LCRA 700 MHz, Live Oak 800 MHz, and Seguin systems. Once the LCRA 700 MHz system is constructed, the system will serve as an interoperability backbone that can be used to interconnect any of the systems within Guadalupe County. The primary limitation of the Guadalupe County system will be the inability to communicate with P25 VHF systems without the use of gateways. When outside of the primary NEXEDGE coverage area, Guadalupe County subscriber radios will be limited to connectivity on VHF conventional systems, which will likely be limited throughout most of the region.

Seguin has invested a significant amount of infrastructure on VHF P25 conventional equipment. L.R. Kimball recommends Seguin upgrade the present VHF equipment to a two-site VHF P25 trunking system. The current system utilizes eight distinct VHF frequency pairs. Prior to the upgrade of the system, L.R. Kimball recommends a frequency analysis be completed to assure that sufficient VHF spectrum is available to support trunking operation. Considering the existing channels licensed by Seguin, channel spacing must be sufficient to permit operation without extensive receiver desense or signal degradation. Channels must also be determined to be sufficiently clear from co-channel and adjacent-channel interference, which can have a negative impact on trunking operation. Channels can be configured in a simulcast or multi-cast configuration; however, based on the size of the coverage area, L.R. Kimball recommends a simulcast design. Backhaul connectivity will be needed to connect the two radio sites. Existing Quantar repeater stations can be reused in a P25 trunking design and existing P25 subscriber radios can be

reused pending a software upgrade. While existing MCC5500 consoles can be reused, separate control stations will be needed for each talk group. L.R. Kimball recommends that the system connect to an existing Motorola P25 master site to minimize costs. The Austin GATRRS switch is the most likely option available. L.R. Kimball recommends that the Seguin system interconnect with the regional LCRA 700 MHz system through three control stations permitting up to three patched talk groups. The talk groups will be used as the primary means to interconnect with users on the regional system. Separate control station interfaces will be needed to interface with the Guadalupe County SO and fire/EMS. L.R. Kimball recommends a minimum of three patched channels for primary SO, fire, and EMS dispatch channels can be shared between the two systems. L.R. Kimball recommends that Seguin install an 800 MHz conventional repeater to be accessed when incoming 700/800 MHz users are not configured to access the 700 MHz LCRA system.

Alternatively, Seguin may evaluate coverage on the existing 700 MHz P25 LCRA network that is currently installed within Guadalupe County. The system provides a coverage footprint in the Seguin area; however, radio sites are located in the New Braunfels and Kingsbury areas. The system is available for use by Seguin as a P25 alternative to VHF. Should Seguin decide to migrate to 700 MHz, no infrastructure costs would be incurred. However, to provide improved in-building and portable coverage, an additional radio site is likely necessary in the Seguin area. The benefit of the system would be improved connectivity with COSA/Bexar County, Live Oak users, New Braunfels, and other 700/800 MHz users. The P25 system will be expanded throughout the region, providing a region-wide footprint for Seguin.

L.R. Kimball recommends that the city of Cibolo migrate to the Live Oak system, which will be merged with COSA/Bexar County. The system will provide an additional radio site that should expand coverage in the Cibolo area. 800 MHz P25 radios will need to be purchased by the city of Cibolo to operate on the system. In the interim L.R. Kimball agrees with Cibolo's plan to purchase multi-band radios to continue operating on the existing VHF system until the COSA/Bexar County system is expanded.

L.R. Kimball recommends that the city of Schertz upgrade their subscriber equipment to P25 when the Live Oak system is integrated with the COSA/Bexar County system and upgraded to P25. Costs are associated with subscriber software upgrades. An additional radio site to improve coverage on the system is reflected in the Bexar County section.

The following table summarizes the channels as they will appear in the Guadalupe County system:

Table 283 – Guadalupe County System Channels

Channel	Description
Channel 1	SO Primary Dispatch
Channel 2	SO TAC1
Channel 3	SO TAC2
Channel 4	SO TAC3
Channel 5	Fire Primary Dispatch
Channel 6	Fire TAC1
Channel 7	Fire TAC2

Channel	Description
Channel 8	Fire TAC3
Channel 9	EMS Dispatch
Channel10	Court House

The following table summarizes the channels as they will appear in the Seguin system:

Table 284 – Seguin System Channels

Channel	Description
Channel 1	PD Dispatch
Channel 2	PD Tac 1
Channel 3	PD Tac 2
Channel 4	SWAT
Channel 5	Fire Dispatch
Channel 6	Fire Backup
Channel 7	Fire Tac 1
Channel 8	Fire Tac 2
Channel 9	VFD Dispatch
Channel 10	VFD Tac 1
Channel 11	VFD Tac 2
Channel 12	Public Works1
Channel 13	Public Works2
Channel14	Utilities 1
	Utilities 2

The following table summarizes details regarding the recommended system for Guadalupe County:

Table 285 – Guadalupe County Radio System Details

Channel	Description
Number of Radio Sites in System:	5
Number of Channels in System:	TBD
Frequency Band:	VHF
Trunking or Conventional:	Trunking
Simulcast (Yes or No)	No
Technology (NB analog, P25, etc)	NXDN (Kenwood NEXEDGE)
Coverage Requirement	95% Portable

Number of Console Positions:	4
Number of subscriber units on system:	Approximately 190
System Reliability	TBD
Encryption	TBD
Telephone Interconnect	No
Private Call	Supported
Growth Flexibility	Pending channel availability
Automatic Vehicle Location	Supported
Emergency Features	Emergency Alert
Specialized Equipment	Mobile Gateway
Equipment Standardization	NXDN (conventional) with gateway connection to P25 systems
Channel Scan	Yes
Unit ID	Yes
Improved Audio Quality	Digital Audio Quality
New Equipment	Replacement subscribers for County (NX-200 Series Kenwood required). New NEXEDGE infrastructure.
Paging and Alert Systems	Maintained on analog

The following table summarizes details regarding the recommended system for Seguin:

Table 286 – Seguin Radio System Details

Channel	Description
Number of Radio Sites in System:	1
Number of Channels in System:	6
Frequency Band:	VHF
Trunking or Conventional:	Trunking
Simulcast (Yes or No)	Yes
Technology (NB analog, P25, etc)	P25 Phase I
Coverage Requirement	95% Portable
Number of Console Positions:	5
Number of subscriber units on system:	Approximately 150
System Reliability	99.999%
Encryption	Supported
Telephone Interconnect	No
Private Call	Supported
Growth Flexibility	Pending channel availability
Automatic Vehicle Location	No
Emergency Features	Emergency Alert

Channel	Description
Specialized Equipment	Mobile Gateway
Equipment Standardization	P25 Phase I with gateway connectivity to NXDN (Guadalupe County) and 700/800 MHz COSA/Bexar County, Live Oak, New Braunfels, 700 MHz LCRA)
Channel Scan	Yes
Unit ID	Yes
Improved Audio Quality	Digital Audio Quality
New Equipment	Upgrade needed for trunking infrastructure, and backhaul connectivity between radio sites.
Paging and Alert Systems	Maintained on analog

7.4.7.2 Cost Estimate

The cost estimate is based on averages for list prices of the typical components of a system with this design. Specific designs will vary in price. Cost savings may be recognized by reusing existing equipment. Cost estimates for the Seguin system assume reuse of existing repeater systems and subscriber equipment. This determination will ultimately be made by the selected vendor.

Table 287 – Guadalupe County Cost Estimates

Component	Cost per Unit	Quantity	Cost
Radio Sites	TBD	5	TBD
Interoperability Control Stations	\$10,000	6	\$60,000
Subscriber Equipment	TBD	190	TBD
Total			TBD

Table 288 – Schertz Cost Estimates

Component	Cost per Unit	Quantity	Cost
Schertz P25 Trunking Upgrades	\$700	94	\$67,900
Total			\$67,900
Subscriber Fees	\$216 / year	94	\$20,304 / year
Ongoing Costs			\$20,304 / year

Table 289 – Seguin Cost Estimates – VHF Trunking

Component	Cost per Unit	Quantity	Cost
Radio Sites	\$300,000	1	\$300,000
800 MHz repeater	\$30,000	1	\$30,000
Interoperability Control Stations	\$10,000	6	\$60,000

Component	Cost per Unit	Quantity	Cost
Subscriber Equipment (software upgrades)	\$1,500	120	\$180,000
VHF Licensing Analysis	\$15,000	1	\$15,000
Total			\$585,000
System maintenance	\$9,750 / year		\$9,750 / year
Ongoing Costs			\$9,750 / year

Table 290 – Sequin Cost Estimates – 700 MHz P25 (Alternate)

Component	Cost per Unit	Quantity	Cost
Radio Sites	\$450,000	1	\$450,000
800 MHz repeater	\$30,000	1	\$30,000
Interoperability Control Stations	\$10,000	6	\$60,000
Subscriber Equipment (software upgrades)	\$3,500	120	\$420,000
Total			\$960,000
Subscriber Fees	\$180 / year	216	\$21,600 / year
Ongoing Costs			\$21,600 / year

Table 291 – Cibolo Cost Estimates

Component	Cost per Unit	Quantity	Cost
Subscriber Replacements (Multi-band)	\$7,000	50	\$350,000
Total			\$350,000
Subscriber Fees	\$216 / year	50	\$10,800 / year
Ongoing Costs			\$10,800 / year

7.4.7.3 Migration Plan

There are several key milestones that must be considered when implementing the Guadalupe County system. These include:

January 1, 2013—While no wideband-only equipment was reported within Guadalupe County, efforts must be undertaken to reprogram equipment in the narrowband mode prior to the narrowband deadline.

End of 2015—While P25 compliance is targeted as a vision more so than a requirement in the SCIP, the end of 2015 has been targeted as the completion date for the regional system. This will align with requirements to meet P25 requirements in the TSICP, which require interoperability channels to operate in the P25 conventional mode by January 1, 2015.

2011

During 2011, L.R. Kimball recommends that Seguin explore opportunities to license VHF spectrum in a trunking configuration. The analysis should look at existing channels licensed by Seguin, and explore additional VHF spectrum opportunities. If insufficient VHF spectrum is available to support trunking operation, L.R. Kimball recommends that Seguin maintain P25 conventional operation, and upgrade to the 700 MHz regional in the future once current equipment reaches its end-of-life.

L.R. Kimball recommends that Seguin install an 800 MHz repeater on the NPSPAC calling channel for interoperability purposes, and interface the repeater with existing MCC5500 consoles.

L.R. Kimball did not acquire an implementation schedule from Guadalupe County for the pending NEXEDGE system. L.R. Kimball assumes that planning, design, and contract negotiations for the system will take place during 2011.

Estimated Cost: \$45,000 (\$15,000 for licensing analysis and \$30,000 for 800 MHz repeater with installation)

2012

L.R. Kimball recommends that Seguin negotiate a contract with a P25 equipment vendor to provide a VHF P25 solution if it is determined that sufficient VHF spectrum exists to support the system. Motorola will have the ability to reuse existing Quantar stations; however, cost savings may be recognized by proceeding with a competitive procurement. During the second half of 2012, L.R. Kimball anticipates that a contract will be signed and a system design will be agreed upon. The design will include radio site locations, frequency assignments, system feature sets, and an implementation plan.

L.R. Kimball anticipates that the Guadalupe County NEXEDGE system will be installed in 2012 in advance of the narrowbanding deadline. During the system installation, control stations should be implemented to provide connectivity with the Seguin and Live Oak systems. The TXLAW2 base station should be maintained, with the channel alias adjusted from "Intercity" to "TXLAW2." The channel should be reprogrammed to the VCALL channel in accordance with the TSICP once it has been updated.

The city of Cibolo will need to assure narrowband operation before the end of 2012. Subscriber radios and base stations will need to be replaced to operate in the narrowband mode. L.R. Kimball recommends that the planned multi-band radios be implemented.

Estimated costs are associated with the implementation of control stations for the Guadalupe County system to integrate with neighboring systems. Costs for the NEXEDGE upgrade have not been considered. Narrowbanding costs have been considered for the city of Cibolo.

Estimated Cost: \$410,000 (\$10,000 per each of six control stations, and \$350,000 for Cibolo radio replacements)

2013

L.R. Kimball recommends that Seguin implement the trunking system during 2013. The first stages of the installation should include ordering equipment and equipment staging. Subscriber programming will be necessary to implement trunking capability in Seguin radios. Equipment staging should include an assembly of the system in a controller environment. Following the successful staging and verification of system performance in a controlled environment,

equipment installation may commence. Seguin will need to complete updates to radio templates, and train radio users with proper operational protocols for trunking system operation. System cutover will prove operationally challenging because the new system will reuse both frequencies and repeater equipment. L.R. Kimball recommends that Seguin pursue cutover options with the vendor to utilize loaner repeaters. The loaner repeaters would replace the current conventional stations. Existing stations would be reconfigured to operate in the trunking system, and would be installed in parallel. Channels would then be cut over to the trunking system one at a time. VHF channels not selected for use in the trunking rotation can be maintained on conventional for utilization during the cutover. Separate control stations will be needed for each talk group on the system if existing MCC5500 consoles are to be reused.

The schedule for the regional 700 MHz system will include P25 operation in Guadalupe County during the second half of 2013. Once the system is implemented, L.R. Kimball recommends that both Seguin and Guadalupe County implement three control stations to interconnect with the system and provide communication to designated Guadalupe County talk groups on the 700 MHz system.

Estimated costs for this phase include implementation of the Seguin P25 system to include the installation of site equipment, subscriber equipment, and interoperability control stations.

Estimated Costs: \$570,000

2014

L.R. Kimball does not recommend any actions by Guadalupe County in 2014.

Estimated Cost: \$0

2015

L.R. Kimball recommends that the city of Schertz upgrade its subscriber equipment to P25 when the Live Oak system is integrated with the COSA/Bexar County system and upgraded to P25.

L.R. Kimball recommends that Cibolo cut over to the COSA/Bexar County system in 2015 when the system is upgraded to P25. Equipment should be deployed in parallel to existing VHF equipment. Talk groups will need to be established on the system for Cibolo primary operation. Once the 800 MHz system is properly configured and the new radio site has been installed, Cibolo users may begin operation on the new system.

Cibolo subscribers should be programmed to access talk groups on the 700 MHz regional system, which will permit communication with other users in Guadalupe County and throughout the AACOG region.

Estimated costs are associated with the replacement of an estimated 50 radios.

Estimated cost: \$67,900 (P25 upgrades for Schertz radios)

Ongoing Costs

Ongoing costs are estimated to include subscriber fees on the regional systems and maintenance fees for the VHF trunking system. Ongoing costs have not been considered for the Guadalupe County NEXEDGE system.

Estimated Cost: \$40,854 (\$20,304 for Shertz, \$9,750 for Seguin, and \$10,800 for Cibolo)

Cost Breakdown by Year

The following table breaks down the system cost on a year-by-year basis.

Table 292 – Guadalupe County Cost Breakdown by Year

Year	Amount	Description
2011	\$45,000	800 MHz repeater and licensing
2012	\$410,000	Cibolo radio replacements and Guadalupe County control stations
2013	\$570,000	Seguin system upgrade for infrastructure and subscribers
2014	\$0	Maintenance costs covered under warranty
2015	\$77,650	Shertz upgrades and Seguin maintenance Costs
2016	\$40,854	Maintenance and subscriber fees
2017	\$40,854	Maintenance and subscriber fees
2018	\$40,854	Maintenance and subscriber fees
2019	\$40,854	Maintenance and subscriber fees
2020	\$40,854	Maintenance and subscriber fees
Total Cost 2011-2020	\$1,306,920	

7.4.7.4 Funding Gap

The following table summarizes the estimated funding gap based upon past and present future funding sources identified by Guadalupe County.

Table 293 – Guadalupe County Funding Gap

	Amount
Past Expenditures (2006 – 2010)	\$846,531
Future Funding (2011 – 2020)	\$155,000
Estimated Costs (2011 – 2020)	\$1,306,920
Total Funding Gap 2011 – 2020	\$1,151,920

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7.4.8 Karnes County

As indicated in the baseline systems assessment, there are several underlying operability and interoperability gaps present within Karnes County today. To summarize these gaps, the following list has been provided.

Coverage—Coverage is provided for Karnes County by two conventional repeater sites. User feedback indicated radio coverage on the system is adequate, but coverage problems do exist.

Capacity—Law enforcement and fire/EMS are limited to three repeater channels. This capacity is insufficient when multiple incidents occur simultaneously. An additional channel is desired for each user group.

7.4.8.1 Recommended System

Karnes County operates a VHF conventional radio system in a mixed analog and P25 mode. Recent grant funding has been utilized to upgrade one repeater and law enforcement subscribers to P25. Based on the limited number of subscriber radios operated by Karnes County, L.R. Kimball recommends that Karnes County continue to invest in VHF infrastructure. To enhance capacity on the system, L.R. Kimball recommends that Karnes County pursue the licensing of two additional VHF repeater pairs. L.R. Kimball recommends that the remaining VHF repeaters be upgraded to P25, and the utility repeaters be maintained in analog conventional mode.

To improve coverage in the northeast portion of the county, L.R. Kimball recommends that Karnes County implement an additional tower site. Karnes County has identified the need to construct a new tower as no existing facilities are available. L.R. Kimball recommends that the new tower site be co-located with the regional 700 MHz P25 system to limit site development costs for the County.

To support countywide roaming for radio users without the need for switching channels between radio sites, L.R. Kimball recommends that the three primary Karnes County sites be implemented in a conventional simulcast configuration with two channels providing countywide coverage. The system will operate in the P25 conventional mode. One channel will be utilized for primary SO dispatch and tactical operations, and one channel will be utilized for fire dispatch and tactical operations. Three additional repeater channels are recommended at the primary Karnes tower for use by Karnes City and public works.

A VHF licensing analysis will be necessary to determine if two VHF repeater pairs can be licensed for countywide operation. An additional repeater pair will be necessary for use at the primary Karnes County radio site. The licensing analysis is recommended to determine the feasibility of expanding the present Karnes County system.

Additional subscriber replacements will be necessary for those agencies operating analog-only radios. The conventional simulcast system will not be capable of operating in a dual analog and digital mode, and thus all subscriber radios must be P25 capable.

The conventional simulcast system will require backhaul between the radio sites. L.R. Kimball has included the cost of a 4.9 GHz microwave network to interconnect the radio sites. Simulcast equipment will be required at each radio site and a centralized digital voter will be necessary at the Karnes County primary radio site.

To support connectivity with VHF and 800 MHz users who do not have the appropriate Karnes County or regional system channels programmed in their radios, L.R. Kimball recommends that Karnes County implement a VHF conventional base station on the VHF calling channel and an 800 MHz repeater on the 800 MHz interoperability calling channel.

P25 subscriber replacements are targeted for 2012 to assure Karnes County complies with the 2012 narrowbanding mandate. Because subscriber models have not been provided, L.R. Kimball has estimated that all non-law enforcement subscriber radios will require replacement.

Upon completion of the regional 700 MHz system in Karnes County, L.R. Kimball recommends that Karnes County interconnect with the system through control stations interconnected on the planned Zetron console. The connectivity will provide the ability for 700/800 MHz anywhere within the AACOG region to communicate within Karnes County. A minimum of two gateway-connected 700 MHz channels is recommended for Karnes County.

In the long-term, L.R. Kimball recommends that Karnes County consider migration to the regional 700 MHz P25 system. As proposed by LCRA, the system will provide 99 percent mobile coverage and 92 percent portable coverage in Karnes County, provide seamless roaming throughout the county, and provide a significant increase to capacity in Karnes County.

The following table summarizes the channels as they will appear in the system:

Table 294 – Karnes County System Channels

Channel	Description
Channel 1	Karnes Primary
Channel 2	Karnes 2
Channel 3	Karnes LE
Channel 4	Karnes Utility 1
Channel 5	Karnes Utility 2

The following table summarizes details regarding the recommended system for Karnes County:

Table 295 – Karnes County Radio System Details

Channel	Description
Number of Radio Sites in System:	3
Number of Channels in System:	5
Frequency Band:	VHF
Trunking or Conventional:	Conventional
Simulcast (Yes or No)	Yes (2 channels)
Technology (NB analog, P25, etc)	P25 Conventional

Channel	Description
Coverage Requirement	95% Mobile
Number of Console Positions:	1
Number of subscriber units on system:	102
System Reliability	99.999%
Encryption	Supported
Telephone Interconnect	No
Private Call	No
Growth Flexibility	Dependent on channel availability or migration to 700 MHz
Automatic Vehicle Location	No
Emergency Features	Emergency alert
Specialized Equipment	Mobile gateway
Equipment Standardization	P25 Conventional by 2012
Channel Scan	Yes
Unit ID	Yes
Improved Audio Quality	Digital Audio Quality
New Equipment	Replacement or analog repeaters and remaining analog subscribers
Paging and Alert Systems	Maintained on analog VHF channel

7.4.8.2 Cost Estimate

The cost estimate is based on averages for list prices of the typical components of a system with this design.

Table 296 – Karnes County Cost Estimates

Component	Cost per Unit	Quantity	Cost
Cost per Site (Conventional Simulcast)	\$200,000	3	\$600,000
Licensing Fees	\$10,000	1	\$10,000
Subscriber Equipment	\$2,000	50	\$100,000
700 MHz Connectivity	\$10,000	2	\$20,000
800 MHz Interoperability Repeater	\$30,000	1	\$30,000
VHF Interoperability Base Station	\$30,000	1	\$30,000
Radio Site Enhancements	\$100,000	2	\$200,000
New Site Development	Cost covered in regional system		
VHF Total			\$990,000
Cost of Migration to 700 MHz LCRA	\$3,500	102	\$357,000
700 MHz Total			\$357,000
VHF System Maintenance	\$17,000 / year		\$17,000 / year
Ongoing Costs (VHF)			\$17,000 / year

7.4.8.3 Migration Plan

There are several key milestones that must be considered when implementing the Karnes County system. These include:

January 1, 2013—While Karnes County subscriber radios are operating in the P25 mode, it will be necessary to program interoperability channels and wideband channels from neighboring systems prior to the narrowbanding deadline.

End of 2015—While P25 compliance is targeted as a vision more so than a requirement in the SCIP, the end of 2015 has been targeted as the completion date for the regional system. This will align with requirements to meet P25 requirements in the TSICP, which require interoperability channels to operate in the P25 conventional mode by January 1, 2015.

2011

During 2011, L.R. Kimball recommends that Karnes County explore licensing opportunities to acquire two additional VHF repeater pairs. VHF frequencies are limited, but easier to acquire in a conventional architecture than in trunking architecture. Potential interference can be mitigated through the implementation of unique NACs and CTCSS tones.

L.R. Kimball recommends that Karnes County continue to replace analog-only public safety subscribers with P25 capable VHF radios as funding becomes available. It is estimated that approximately 25 radios will be replaced during 2011.

L.R. Kimball recommends that Karnes County enhance the existing two radio sites with improved shelters, generators, UPS units, and grounding. L.R. Kimball recommends that development of the LCRA tower site for the regional system begin during 2012.

Estimated Cost: \$260,000 (subscriber replacements for half of remaining analog subscribers, licensing fees, and radio site development)

2012

During 2012, L.R. Kimball recommends that Karnes County procure and install the countywide conventional simulcast system for use by public safety, and reprogram the existing analog repeaters to the new channels for use by the utility companies. If possible the existing Karnes primary channels will be used in the countywide design to limit the need for reprogramming of primary dispatch channels and to limit the impact on neighboring agencies that interoperate on Karnes County utilizing the primary channels.

L.R. Kimball recommends that Karnes County replace the remaining analog subscriber radios with P25 capable subscribers.

Radio programming will be necessary to update narrowband interoperability channels.

Estimated costs are associated with the purchase and installation of the conventional simulcast system, interoperability repeaters, and the replacement of approximately 25 radios.

Estimated Cost: \$710,000 (conventional simulcast system, interoperability repeaters, and subscriber replacements)

2013 – 2016

L.R. Kimball recommends that Karnes County establish connectivity to the LCRA 700 MHz P25 system once the system has been expanded within Karnes County. Connectivity will require the installation of two control stations to provide connectivity with designated interoperability talk groups on the system.

Estimated Cost: \$20,000 (P25 700 MHz control stations)

2017 – 2020

L.R. Kimball recommends that Karnes County explore the potential migration to the LCRA 700 MHz P25 system as subscriber equipment ages and requires replacement. Migration would require that system coverage is adequate for use by Karnes County.

Estimated Cost: \$357,000 (102 radios at \$3,500 per radio)

Ongoing Costs

L.R. Kimball estimates that ongoing fees will be attributed to maintenance on the VHF conventional simulcast system. Maintenance costs are estimated at 2.5 percent of the fixed infrastructure cost or \$17,000 / year. Following a migration to 700 MHz P25, costs will be attributed to subscriber fees on the system. Estimated subscriber fees on the LCRA system are \$18,360 / year.

Cost Breakdown by Year

The following table breaks down the system cost on a year-by-year basis.

Table 297 – Karnes County Cost Breakdown by Year

Year	Amount	Description
2011	\$260,00	Subscriber replacements, licensing fees, and site development
2012	\$710,00	Conventional simulcast system and subscriber replacements
2013	\$20,000	LCRA 700 MHz system connectivity
2014	\$17,000	Maintenance fees
2015	\$17,000	Maintenance fees
2016	\$17,000	Maintenance fees
2017	\$17,000	Maintenance fees
2018	\$17,000	Maintenance fees
2019	\$17,000	Maintenance fees
2020	\$357,000	700 MHz Migration
Total Cost 2011-2020	\$1,449,000	

7.4.8.4 Funding Gap

The following table summarizes the estimated funding gap based upon past and present future funding sources identified by Karnes County:

Table 298 – Karnes County Funding Gap

	Amount
Past Expenditures (2006 – 2010)	\$194,000
Future Funding (2011 – 2020)	--
Estimated Costs (2011 – 2020)	\$1,449,000
Total Funding Gap 2011 – 2020	\$1,449,000

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7.4.9 Kendall County

As indicated in the baseline systems assessment, there are several underlying operability and interoperability gaps present within Kendall County today. To summarize these gaps, the following list has been provided.

Coverage—Coverage on the fire/EMS system is limited to a single repeater for dispatch, and conventional repeaters scattered throughout the county that are managed by individual VFDs. User feedback indicated a multi-site trunking system is desired to enhance countywide coverage.

Capacity—Capacity on the fire/EMS system was indicated to be a major problem. User feedback indicates that an additional five to seven channels are necessary to meet capacity needs

Narrowbanding—Much of the Kendall County fire/EMS subscriber fleet is not narrowbanding capable. Radio upgrades are needed prior to the narrowbanding cutover January 1, 2013.

Interoperability—Interoperability gaps were identified for users on the LCRA EDACS system with numerous neighboring agencies.

OpenSky Migration—The pending migration of the LCRA system to OpenSky will require Kendall County to upgrade to OpenSky, upgrade to the LCRA 700 MHz system, or pursue an alternative system option.

7.4.9.1 Recommended System

L.R. Kimball recommends that all emergency responders within Kendall County migrate to the LCRA 700 MHz P25 system. L.R. Kimball understands the desire to migrate to the NEXEDGE platform. While P25 is a more expensive alternative, the 700 MHz P25 system will provide significantly more capacity than what is available in the VHF band, and will provide TDMA capability prior to the FCC's narrowbanding deadline. Operation on the P25 system will provide significantly improved interoperability with COSA/Bexar County and with other jurisdictions throughout the AACOG region. Fixed infrastructure costs for the system covered by AACOG will significantly reduce upgrade requirements, and limit the necessary investment to subscriber radios, consoles, and usage fees. The current LCRA 900 MHz system provides approximately 96 percent mobile coverage and 83 percent portable coverage in Kendall County. Equivalent coverage levels can be anticipated once the 700 MHz overlay has been installed. Plans are in place to upgrade the existing Zetron consoles to Harris MAESTRO consoles, which will support full trunking features.

Migration to the system will require the complete replacement of all subscriber radios by emergency responders within Kendall County. Radios currently used by Kendall County law enforcement and the city of Boerne will not operate on the 700 MHz system. However, numerous M5300 and P5300 radios are utilized, which are capable of operating in an OpenSky configuration. To permit a prolonged upgrade period, 5300 series radios can be programmed to operate on the OpenSky system. Channels on the system could be patched to 700 MHz channels to permit operation by Kendall County on both systems. During this period, 900 MHz and 700 MHz radios users will not be capable of direct unit-to-unit communications. The radio distribution primarily utilized 5300 series radios for mobile operation and LPE series radios for portable operation. Replacement of portable radios with 700 MHz P25 radios will limit potential interoperability or talkaround gaps. 5300 series OpenSky radios could then be replaced with P25 radios as they reach the end of their life cycle.

Users on the fire/EMS system would migrate to the 700 MHz system during 2012 to ensure system operation prior to the narrowbanding deadline. Law enforcement users on the EDACS system would migrate to the OpenSky or P25 system prior to the decommissioning of the EDACS system by LCRA.

L.R. Kimball recommends that base stations be maintained on the VHF and 800 MHz calling channels to provide interoperable capabilities with incoming radio users that may not be programmed to correctly access the 700 MHz trunking system. L.R. Kimball recommends that the primary VHF repeater channel be maintained for interoperability purposes.

The following table summarizes the channels as they will appear in the system:

Table 299 – Kendall County System Channels

Channel	Description
Channel 1	Boerne PD1
Channel 2	Boerne PD ALL CALL
Channel 3	Boerne PD Information
Channel 4	Boerne PD old Intercity Car to car
Channel 5	Boerne PD Primary
Channel 6	Boerne PD Tactical
Channel 7	Boerne Utility 1
Channel 8	Boerne Utility 2
Channel 9	Kendall Fire Dispatch
Channel 10	Alamo Springs FD TAC
Channel 11	Bergheim FD TAC
Channel 12	Boerne FD TAC
Channel 13	Comfort FD TAC
Channel 14	Kendalia FD TAC
Channel 15	Sisterdale FD TAC
Channel 16	Waring FD TAC
Channel 17	Kendall County Constables
Channel 18	Kendall County EMS
Channel 19	Kendall County General Government
Channel 20	Kendall County SO 1
Channel 21	Kendall County SO Admin
Channel 22	Kendall County SO Criminal Investigations Division
Channel 23	Kendall County SO Special Operations 1
Channel 24	Kendall County SO Special Operations 2

Channel	Description
Channel 25	Kendall County SO VHF (patch)

The following table summarizes details regarding the recommended system for Kendall County:

Table 300 – Kendall County Radio System Details

Channel	Description
Number of Radio Sites in System:	3 (LCRA System)
Number of Channels in System:	15+ (Average 5/site)
Frequency Band:	700 MHz
Trunking or Conventional:	Trunking
Simulcast (Yes or No)	No
Technology (NB analog, P25, etc)	P25 Phase I with Phase II by 2017
Coverage Requirement	96% mobile 83% portable (LCRA today)
Number of Console Positions:	4
Number of subscriber units on system:	Approximately 477
System Reliability	99.999%
Encryption	Supported
Telephone Interconnect	Supported
Private Call	Supported
Growth Flexibility	Coverage and capacity flexible
Automatic Vehicle Location	Not initially supported
Emergency Features	Emergency alert
Specialized Equipment	Mobile gateway
Equipment Standardization	P25 Phase I 700 MHz with Phase II Upgradeable
Channel Scan	Yes
Unit ID	Yes
Improved Audio Quality	Digital audio quality
New Equipment	Replacement subscriber equipment
Paging and Alert Systems	Maintained on VHF

7.4.9.2 Cost Estimate

The cost estimate is based on averages for list prices of the typical components of a system with this design. Specific designs will vary in price. Cost savings may be recognized by reusing existing equipment. This determination will ultimately be made by the selected vendor.

Table 301 – Kendall County Cost Estimates

Component	Cost per Unit	Quantity	Cost
Subscriber Equipment	\$3,500	477	\$1,669,500
VHF Repeater	\$30,000	1	\$30,000
800 MHz Repeater	\$30,000	1	\$30,000
OpenSky Software upgrades	\$300	160	\$48,000
Total			\$1,777,500
Subscriber Fees	\$180	477	\$85,860 / year
Ongoing Costs			\$85,860 / year

7.4.9.3 Migration Plan

There are several key milestones that must be considered for migration to the P25 700 MHz regional system. These include:

January 1, 2013—Kendall County operates numerous radios that will not meet the narrowbanding deadline, and must be fully operational on the system by January 1, 2013. The purpose would be to avoid spending money on both narrowbanding and 700 MHz radios.

End of 2014—The LCRA EDACS system is scheduled to be decommissioned by the end of 2014. Users on the system must migrate to either the OpenSky or 700 MHz systems prior to the decommissioning of the EDACS system.

End of 2015—While P25 compliance is targeted as a vision more so than a requirement in the SCIP, the end of 2015 has been targeted as the completion date for the regional system. This will align with requirements to meet P25 requirements in the TSICP, which require interoperability channels to operate in the P25 conventional mode by January 1, 2015.

2011

L.R. Kimball recommends that Kendall County purchase an 800 MHz repeater on the NPSPAC calling channel and interface the repeater with the MAESTRO consoles. The channel will permit 800 MHz connectivity for 800 MHz radios not programmed for operation on the 700 MHz P25 regional LCRA system. COSA/Bexar County users that do not yet have P25 radios will be able to communicate in Kendall County using the interoperability repeater.

Costs associated with migration to the LCRA OpenSky or 700 MHz systems are anticipated during 2012.

Estimated Cost: \$30,000 (800 MHz repeater)

2012

L.R. Kimball recommends that fire/EMS users migrate to the LCRA 700 MHz system during the fourth quarter of 2012. 700 MHz subscribers should be issued to all fire/EMS users in addition to the existing VHF radios to permit migration, with fallback options available on VHF in the event the system does not function correctly. Upon the

successful cutover to the LCRA system, L.R. Kimball recommends that VHF equipment be maintained for a period of one month to assure the P25 system functions correctly. Subscriber fleet maps will need to be developed for fire/EMS users, and user training will be needed to acquaint fire/EMS users with trunking system operation on new subscriber radios. Specific talk groups will need to be established to interconnect fire/EMS users with law enforcement users who remain on the EDACS system. L.R. Kimball recommends that gateway connections on the two systems be established by LCRA so that talk groups on the EDACS system are duplicated on the 900 MHz and OpenSky systems to permit seamless communication by users in Kendall County during the transmission.

L.R. Kimball recommends that the primary repeater be replaced with a VHF analog repeater, which will be maintained for interoperability purposes. The channel will be gateway connected to an LCRA talk group at the Kendall County PSAP.

Costs associated with this phase include the replacement of approximately 200 subscriber radios on the fire/EMS radio system and the replacement of the primary VHF repeater.

Estimated Cost: \$730,000 (200 radios at \$3,500 per radio, plus 1 repeater at \$30,000)

2013

L.R. Kimball recommends that Kendall County upgrade 5300 series radios to the LCRA OpenSky system. Operation on the OpenSky system should appear seamless for users on EDACS, OpenSky, or 700 MHz systems. L.R. Kimball notes that the 5300 series radios will ultimately be replaced with 700 MHz radios. It is estimated that the upgrade will prolong the life of the radios for an average of five years.

Costs associated with the upgrade include software upgrades for 160 Harris 5300 series radios.

Estimated Cost: \$48,000 (software upgrades for 160 radios at \$300 per radio)

2014

L.R. Kimball recommends that Kendall County replace the remaining LPE Orion radios on the EDACS system with 700 MHz P25 radios that will operate on the 700 MHz system. Users will require training for the new subscriber radios.

Costs associated with these modifications reflect the replacement of approximately 117 LPE Orion radios.

Estimated Cost: \$409,500 (117 radios at \$3,500 per radio)

2015 – 2020

L.R. Kimball recommends that Kendall County replace the remaining 5300 series radios with P25 radios as equipment fails and requires replacement. L.R. Kimball recommends that all 5300 series radios be replaced prior to 2020.

Estimated Cost: \$560,000 (160 radios at \$3,500 per radio)

Ongoing Costs

L. R. Kimball estimates that ongoing costs will be attributed with yearly subscriber fees for use of the LCRA managed system. Estimated subscriber fees for 477 radios at \$180 / year total \$85,860.

Estimated Cost: \$85,860 / year

Cost Breakdown by Year

The following table breaks down the system cost on a year-by-year basis.

Table 302 – Kendall County Cost Breakdown by Year

Year	Amount	Description
2011	\$30,000	800 MHz interoperability repeater
2012	\$730,000	Replacement of fire/EMS radios and purchase of narrowband VHF repeater
2013	\$48,000	Upgrade of 5300 Series radios
2014	\$409,500	Replacement of 117 LPE Orion radios
2015	\$179,193	Subscriber fees and radio replacements
2016	\$179,193	Subscriber fees and radio replacements
2017	\$179,193	Subscriber fees and radio replacements
2018	\$179,193	Subscriber fees and radio replacements
2019	\$179,193	Subscriber fees and radio replacements
2020	\$179,193	Subscriber fees and radio replacements
Total Cost 2011-2020	\$2,292,658	

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7.4.9.4 Funding Gap

The following table summarizes the estimated funding gap based upon past and present future funding sources identified by Kendall County:

Table 303 – Kendall County Funding Gap

	Amount
Past Expenditures (2006 – 2010)	\$23,352
Future Funding (2011 – 2020)	\$557,932
Estimated Costs (2011 – 2020)	\$2,292,658
Total Funding Gap 2011 – 2020	\$1,734,726

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7.4.10 Kerr County

As indicated in the baseline systems assessment, there are several underlying operability and interoperability gaps present within Kerr County today. To summarize these gaps, the following list has been provided.

Split Resources—Kerr County includes five distinct radio systems, many of which providing overlapping coverage areas with radio sites in close proximity. Cost savings can be recognized through the implementation of a shared countywide network.

Interoperability—Interoperability is adequate among VHF users within Kerr County, but is limited with 800 MHz users and utility agencies.

Conventional Architecture—The Kerrville FD system uses a conventional architecture, requiring users to switch channels as they roam between radio sites.

Coverage—Minor coverage problems were reported on most of the Kerrville radio systems.

P25 Upgrades—VFDs within Kerr County utilize aging equipment that must be replaced to operate on the P25 standard. Some VFD radios require replacement prior to the narrowbanding deadline.

7.4.10.1 Recommended System

Based on the needs of the various user groups within Kerr County, L.R. Kimball recommends that all emergency responders within Kerr County migrate toward a shared countywide P25 trunking system. A trunking system would provide a single P25 compliant solution that would meet the coverage, capacity, and interoperability needs of all emergency users within Kerr County. The shared system would utilize the minimum number of radio sites necessary to provide countywide portable coverage, minimizing overall costs for the various stakeholder groups.

L.R. Kimball recommends that the system utilize multicast technology, with five distinct frequencies at each of four radio sites. The use of multicast radio sites will allow for more flexibility with frequency allocation, and eliminate potential problems with simulcast overlap areas. The system will provide seamless site-to-site roaming without requiring users to switch channels, which is similar to the operation on the present Kerr County SO system. The primary benefit of the trunking architecture compared to the conventional simulcast system used by the SO is the assignment of dynamically allocated talk groups. The trunking system will allow a near unlimited number of user talk groups that will be dynamically assigned to specific frequencies by the radio system. When the radio call ends, the frequency is cleared and assigned to the next talk group call. The system would provide much more efficient use of radio spectrum than a conventional system and allow any user group to have a private channel without building a separate repeater and acquiring additional frequencies.

The system will support the P25 protocol, support encryption capabilities, permit future data applications such as AVL, and provide a scalable architecture that can meet the needs of Kerr County for years to come.

There are two primary options for Kerr County to migrate toward a trunked platform: migration to the regional 700 MHz system or build out of a VHF trunking system. Of the two options, migration to the 700 MHz system is more desirable. The cost for fixed infrastructure on the system will be covered by AACOG, leaving only the cost of

subscriber equipment for Kerr County. The cost of a 700 MHz migration will be significantly less than the build out of a VHF trunking system. L.R. Kimball recognizes that the driving factor behind a potential 700 MHz migration is whether or not the system will be built out prior to the narrowbanding deadline and the end-of-life on the existing conventional simulcast system.

For the 700 MHz option, it is recommended that 700 MHz radios be purchased to replace wideband analog equipment. Because this will place individual VFDs with some users utilizing VHF radios and some users utilizing 700 MHz radios, L.R. Kimball recommends that all existing VHF channels be permanently patched to talk groups on the 700 MHz system. This will permit all traffic from one frequency band to be repeated on the other frequency band. Communication will be acceptable permitting that radio users are in both the VHF and 700 MHz systems coverage footprints. To permit cross-band simplex operation, L.R. Kimball recommends that each VFD that will utilize both VHF and 700 MHz radios have a cross-band gateway unit. The unit will be small and transportable, and permit a patch that will allow on-scene talkaround between frequency bands.

Alternatively, a VHF trunking system is an option for Kerr County. Cost savings for the system can be recognized by utilizing existing P25 subscribers and repeaters. Motorola XTS and XTL series radios possess the capability for P25 trunking, but require software upgrades to operate on a trunking system. Existing Quantar stations are capable of operating on a P25 trunking system, but may require hardware or software upgrades to function properly. Quantar stations can only be re-used if a Motorola solution is selected. Cost savings of one to two million dollars can be recognized by utilizing an existing P25 controller. Available P25 cores include the GATTRS core in Austin (Motorola) and the LCRA core in Austin (Harris). Existing microwave networks used on the SO system could potentially be reused in trunking architecture. Additional cost savings may be recognized through a competitive procurement process.

The primary limitation with a VHF trunking design is the availability of interference-free VHF spectrum. VHF trunking sites require adequate transmitter-to-receiver spacing on all channels. Common problems with VHF trunking systems include receiver desense resulting from insufficient channel spacing and intermodulation, and interference received from neighboring co-channel or adjacent-channel systems. To address potential VHF spectrum conflicts, L.R. Kimball recommends that Kerr County acquire consulting services to determine if VHF spectrum is suitable for a trunking system in the county. L.R. Kimball tabulated 15 VHF repeater pairs and two simplex channels used within Kerr County today. Based on the number of channels licensed, there is an opportunity for existing spectrum to be reshuffled throughout the county to be utilized in a trunking configuration. However, it is not likely that all existing channels will be able to be utilized, and additional spectrum will likely be necessary. If insufficient VHF channels are identified, L.R. Kimball recommends Kerrville explore a simulcast solution. The simulcast solution will require more repeater stations at each radio site and additional simulcast equipment, but will make more efficient use of spectrum. The Part 22 paging channels utilized on the Kerr County FIRECOM system are ideal for trunking operation due to proper transmitter-to-receiver spacing and a lack of potential interfering agencies. However, L.R. Kimball notes that a waiver is necessary to properly license Part 22 channels to Kerr County. If it is determined that VHF spectrum is not available to support system operation, then a 700 MHz migration is the only option.

To provide regional interoperability, L.R. Kimball recommends that the Kerr County VHF system interconnect to the regional LCRA 700 MHz system through five patched channels. The connection will permit roaming from any 700/800 MHz users in the region in Kerr County, provided that interoperability talk groups are properly programmed. L.R. Kimball recommends that two talk groups on the regional system be assigned specifically to Kerr County for

interoperability purposes. To support the operation of 700/800 MHz radios that are not properly programmed on the regional system, L.R. Kimball recommends that Kerr County install an 800 MHz NPSPAC repeater on the 8CALL90 channel.

The following table summarizes the channels as they will appear in the system:

Table 304 – Kerr County System Channels

Channel	Description
Channel 1	Kerr County Fire Dispatch
Channel 2	Center Point VFD TAC
Channel 3	Junction VFD TAC
Channel 4	Comfort VFD TAC
Channel 5	Mountain Home VFD TAC
Channel 6	Elm Pass VFD TAC
Channel 7	Tierra Linda VFD TAC
Channel 8	Hunt VFD TAC
Channel 9	Turtle Creek VFD TAC
Channel 10	Ingram VFD TAC
Channel 11	Kerr County SO Dispatch
Channel 12	Kerr County SO TAC 1
Channel 13	Kerr County SO TAC 2
Channel 14	Kerr County SO TAC 3
Channel 15	Kerrville Fire/EMS Dispatch
Channel 16	KFD TAC 1
Channel 17	KFD TAC 2
Channel 18	Kerrville EMS
Channel 19	Kerrville PD Dispatch
Channel 20	Kerrville TAC1
Channel 21	Kerrville TAC2
Channel 22	Ingram Dispatch
Channel 23	Ingram TAC

The following table summarizes details regarding the recommended system for Kerr County:

Table 305 – Kerr County Radio System Details

Channel	Description
Number of Radio Sites in System:	5 (LCRA Sites providing coverage in Kerr County)

Channel	Description
Number of Channels in System:	Approximately 25 (5 per site)
Frequency Band:	700 MHz
Trunking or Conventional:	Trunking
Simulcast (Yes or No)	No
Technology (NB analog, P25, etc)	P25 Phase I with Phase II Upgrade Path
Coverage Requirement	90% Portable
Number of Console Positions:	6
Number of subscriber units on system:	650
System Reliability	99.999%
Encryption	Yes
Telephone Interconnect	Supported
Private Call	Supported
Growth Flexibility	Flexible in Coverage and Capacity
Automatic Vehicle Location	Not initially supported
Emergency Features	Emergency Alert
Specialized Equipment	Mobile gateway
Equipment Standardization	P25 Phase I 700 MHz
Channel Scan	Yes
Unit ID	Yes
Improved Audio Quality	Digital Audio Quality
New Equipment	Fixed infrastructure, consoles, and subscriber software upgrades
Paging and Alert Systems	Maintained on analog

7.4.10.2 Cost Estimate

The cost estimate is based on averages for list prices of the typical components of a system with this design. Specific designs will vary in price. Cost savings may be recognized by reusing existing equipment. This determination will ultimately be made by the selected vendor.

Table 306 – Kerr County 700 MHz Cost Estimates

Component	Cost per Unit	Quantity	Cost
Consoles	\$60,000	6	\$360,000
Subscriber Replacements	\$3,500	650	\$2,275,000
800 MHz Repeater	\$30,000	1	\$30,000
Cross-band Mobile Gateways	\$10,000	5	\$50,000
Total			\$2,715,000
Subscriber Fees	\$180 / year	650	\$117,000 / year

Component	Cost per Unit	Quantity	Cost
Ongoing costs			\$117,000 / year

Table 307 – Kerr County VHF Cost Estimates

Component	Cost per Unit	Quantity	Cost
Cost per site	\$490,000	4	\$1,960,000
Consoles	\$60,000	6	\$360,000
Subscriber Replacements	\$3,500	330	\$1,155,000
Subscriber Software Upgrades	\$1,500	320	\$480,000
Licensing Services	\$20,000	1	\$20,000
800 MHz Repeater	\$30,000	1	\$30,000
700 MHz Control Stations	\$10,000	5	\$50,000
Total			\$4,055,000
Maintenance Fees	\$60,000 / year		\$60,000 / year
Ongoing costs			\$60,000 / year

7.4.10.3 Migration Plan

There are several key milestones that must be considered for migration to the countywide VHF P25 system. These include:

January 1, 2013—Kerr County operates several radios that must be replaced to meet the narrowbanding deadline. The remaining wideband fire channels must be reprogrammed in the narrowband mode prior to January 1, 2013.

End of 2015—While P25 compliance is targeted as a vision more so than a requirement in the SCIP, the end of 2015 is the targeted date for statewide P25 compliance.

2011

L.R. Kimball recommends that Kerr County provide a more detailed survey of the VFD subscriber radios to obtain a more accurate count of which radios are not narrowbanding capable. Kerr County must confirm with AACOG and LCRA that the regional system will be up and operational prior to the narrowbanding deadline. If this is the case, VFDs within Kerr County should plan on purchasing 700 MHz P25 subscribers to replace wideband radios in the 2012 timeframe once the system is up and operational.

In the event that Kerr County pursues a VHF system, L.R. Kimball recommends that Kerr County pursue services to analyze the availability of VHF spectrum for use in a Kerr County countywide trunking system. The results of the survey will determine whether Kerr County pursues a simulcast design, multicast design, or a different system design altogether.

L.R. Kimball recommends that Kerr County continue to replace aging VFD radios with P25 capable VHF radios. It is estimated that approximately half of the remaining non-P25 radios used by Kerr County VFDs will be replaced in 2011.

L.R. Kimball recommends that Kerr County implement an 800 MHz NPSPAC interoperability repeater during 2011.

Estimated Cost for 700 MHz Option: \$30,000 (800 MHz repeater)

Estimated Cost for VHF Option: \$627,500 (165 radios at \$3,500 per radio; \$20,000 in licensing fees; and \$30,000 for an 800 MHz repeater)

2012

For the 700 MHz option, L.R. Kimball recommends that the primary migration begin to take place during 2012.

L.R. Kimball recommends that 700 MHz trunking radios be purchased to replace any remaining wideband analog radios. To permit the use of both VHF and 700 MHz by individual VFDs, L.R. Kimball recommends that all existing VHF channels be permanently patched to talk groups on the 700 MHz regional system. The connectivity will limit cross-band talk around, but permit communication so long as radio users are within the coverage footprint of the two systems. Deployable gateways will be provided to those departments that utilize both VHF and 700 MHz radios. The units can be used to provide an on-scene patch to permit simplex operation between users with VHF and 700 MHz radios. Permitted that no additional 700 MHz talk groups are created, no modifications will be necessary for the dispatch consoles as all 700 MHz traffic on primary channels will be repeated on existing VHF channels.

The remaining VHF subscribers and equipment will need to be narrowbanded during 2012. Changes should primarily require the reprogramming of VHF equipment. If they are not already included, the narrowband VHF interoperability channels should be added when the radios are reprogrammed. Console replacements are recommended in 2012.

Estimated costs for the 700 MHz option are associated with the replacement of approximately 170 radios, which will incorporate any remaining wideband analog radios, and the deployment of cross-band gateways.

L.R. Kimball recommends that Kerr County interface with the regional LCRA P25 700 MHz system during 2012 when the system is installed within Kerr County. L.R. Kimball recommends that five talk groups be interconnected on the Kerr County dispatch consoles. Two of those talk groups will be permanently-assigned Kerr County interoperability talk groups that incoming 700/800 MHz users will use to communicate with Kerr County. The system will provide up to five shared talk groups between the Kerr County trunking system and the 700 MHz regional P25 system. The 800 MHz NPSPAC repeater may be utilized in the event that incoming 800 MHz users are not P25 capable or programmed to access the LCRA P25 system. Connectivity is recommended for both the 700 MHz and VHF options.

Estimated Cost for 700 MHz Option: \$695,000 (Replacement of 170 subscribers, deployment of five cross-band gateways, and connectivity to regional system)

For the VHF option, L.R. Kimball recommends that Kerr County pursue a contract with an equipment vendor in 2012. Kerr County must decide whether to pursue a sole source contract with a desired vendor or pursue a competitive procurement. In general, L.R. Kimball recommends a competitive procurement process whereby Kerr County would

develop an RFP and solicit competitive proposals from multiple equipment vendors. L.R. Kimball recommends that Kerr County target the end of 2012 for a signed contract date.

L.R. Kimball recommends that Kerr County replace the remaining analog VFD radios with P25 radios during 2012. It is estimated that 55 radios will require replacement during this period.

Estimated Cost: \$577,500 (165 radios at \$3,500 per radio and connectivity to the regional system)

2013

For the 700 MHz option, L.R. Kimball recommends that Kerr County and the Kerrville FD begin migration to the 700 MHz regional system. Initially, 700 MHz subscribers may be deployed in parallel to VHF subscribers to permit ongoing interoperability while users become adjusted to the new system. 700 MHz migration is targeted to start in 2013 to permit operation before the conventional simulcast system is no longer operable. L.R. Kimball recommends that all subscribers be deployed for each department at once to limit dependence on cross-band communication. L.R. Kimball recommends that VFDs continue to replace aging analog radios with 700 MHz radios.

Estimated costs are associated with the replacement of approximately 170 subscriber radios.

Estimated cost for 700 MHz option: \$595,000 (170 radios at \$3,500 per radio)

For the VHF option, L.R. Kimball recommends that system installation take place during 2013. System installation will first include the ordering and staging of equipment. L.R. Kimball recommends that equipment staging be completed so that Kerr County can verify system operation in a controlled environment. Upon successful testing of the system in a staged environment, equipment installation should take place. Subscriber fleet maps must be developed for trunking talk groups. Talk groups should closely align with existing channel names to limit confusion during the transition. Users must be properly trained on operational variations on the trunking system, such as waiting for a channel clear notification when a PTT is pressed.

The system should be installed in parallel to existing equipment if radio sites are re-used. Cutover to this system will be a challenge due to the likely reuse of VHF channels. L.R. Kimball recommends that newly licensed channels, not utilized elsewhere within the county, be cut over first. L.R. Kimball recommends that conventional channels be identified that user groups can share so that unused channels can be cutover. Testing on the system can be conducted using a single channel to verify radio system coverage and proper performance. Once testing is complete and approximately half of the channels on the new system have been turned on, user groups may begin cutting over. The transition from the user perspective should include little more than changing channels on existing subscriber equipment. If the system does not function properly during cutover, users may revert to the conventional channels until the problem is corrected.

Existing P25 conventional radios will need to be upgraded with trunking features at the cost of approximately \$1,500 per radio.

Costs for this phase reflect the installation of fixed infrastructure, installation of dispatch consoles, and radio upgrades.

Estimated Cost: \$2,800,000 (fixed infrastructure, consoles, and upgrade of 320 P25 capable radios)

2014

L.R. Kimball recommends that Kerr County continue to replace VHF radios with 700 MHz trunking subscribers. Estimated costs are associated with the replacement of 170 subscriber radios.

Estimated cost for 700 MHz option: \$595,000 (170 radios at \$3,500 per radio)

For the VHF option, L.R. Kimball has no recommended action for 2014.

Estimated cost for VHF Option: \$0

2015

For the 700 MHz option, L.R. Kimball recommends that the remaining VHF radios within Kerr County be replaced with 700 MHz radios. Once all VHF radios have been replaced, Kerr County may implement additional talk groups on the 700 MHz system. Dispatch consoles are recommended for replacement with IP-based trunking consoles. Leased lines with backup control stations are recommended for connectivity between the dispatch consoles and the 700 MHz network.

Estimated costs are associated with the replacement of the remaining VHF radios (approximately 140) and the replacement of six dispatch consoles.

Estimated cost for 700 MHz option: \$850,000 (140 radios at \$3,500 per radio and \$360,000 for dispatch consoles)

Ongoing Fees

Ongoing costs for the 700 MHz option are associated with subscriber fees. For 650 subscriber radios at a fee of \$180 per year, the estimated subscriber fees total \$117,000 per year.

For the VHF option, ongoing fees are attributed to system maintenance costs. Maintenance costs are estimated at 2.5 percent of the fixed infrastructure total or \$60,000 / year.

Cost Breakdown by Year

The following table breaks down the system cost on a year-by-year basis.

Table 308 – Kerr County 700 MHz Cost Breakdown by Year

Year	Amount	Description
2011	\$30,000	800 MHz Interoperability Repeater
2012	\$695,000	Subscriber replacements, gateway deployment, and regional connectivity
2013	\$625,600	Subscriber replacements and subscriber fees
2014	\$656,200	Subscriber replacements and subscriber fees
2015	\$941,800	Subscriber replacements, console replacements, and subscriber fees

Year	Amount	Description
2016	\$117,000	Subscriber fees
2017	\$117,000	Subscriber fees
2018	\$117,000	Subscriber fees
2019	\$117,000	Subscriber fees
2020	\$117,000	Subscriber fees
Total Cost 2011-2020	\$3,533,600	

Table 309 – Kerr County VHF Cost Breakdown by Year

Year	Amount	Description
2011	\$627,500	Subscriber replacements, licensing fees, and 800 MHz repeater
2012	\$627,500	Subscriber replacements
2013	\$2,800,000	Radio system fixed infrastructure and console replacements
2014	\$0	System maintenance covered under warranty
2015	\$60,000	System maintenance
2016	\$60,000	System maintenance
2017	\$60,000	System maintenance
2018	\$60,000	System maintenance
2019	\$60,000	System maintenance
2020	\$60,000	System maintenance
Total Cost 2011-2020	\$4,415,000	

7.4.10.4 Funding Gap

The following table summarizes the estimated funding gap based upon past and present future funding sources identified by Kerr County:

Table 310 – Kerr County Funding Gap

	Amount
Past Expenditures (2006 – 2010)	\$859,510
Future Funding (2011 – 2020)	\$758,000
Estimated Costs 700 MHz (2011 – 2020)	\$3,553,600
Estimated Costs VHF (2011 – 2020)	\$4,415,000
Total Funding Gap 700 MHz 2011 – 2020	\$2,795,600
Total Funding VHF 2011 – 2020	\$3,657,000

7.4.11 Medina County

L.R. Kimball has not yet had the opportunity to meet with representatives from Medina County. The recommended system and migration strategy outlined is based upon data collected from FCC licenses and information gathered during verbal discussion regarding the planned VHF trunking system.

7.4.11.1 Recommended System

Based on assumptions made from FCC licenses and data provided by Medina County, L.R. Kimball understands Medina County plans to implement a VHF P25 trunking system utilizing five radio sites located in the Hondo, Castroville, Natalia, D'Hanis, and Mico areas. Radio sites will each have distinct VHF frequency pairs, with five frequencies licensed at the Hondo site, three frequencies licensed at the Natalia site, two frequencies licensed at the D'Hanis site, two frequencies licensed at the Mico site, and three frequencies licensed at the Castroville site.

L.R. Kimball concurs with the plan to implement a countywide trunking system. While the trunking will likely solve coverage and capacity problems experienced on the present conventional systems, L.R. Kimball does not have sufficient information to recommend solutions for all potential problems experienced by Medina County users.

L.R. Kimball recommends that the radio sites be interconnected with an existing P25 core to limit expenses for the purchase of a designated system controller. Cost savings may also be recognized by procuring the system from an equipment vendor that does not utilize central switching technology such as E.F. Johnson, Raytheon, or EADS. The greatest cost savings will be recognized if Medina County proceeds with a competitive procurement for the system.

Coverage estimates for the proposed design provide adequate coverage; however, coverage gaps are predicted to exist along the northern border. Additional radio sites may be necessary to supplement coverage in these areas in the future. Radio sites in the Hondo and Castroville areas are in close proximity and could potentially contribute to extensive loading on both radio sites if users on the same talk group operate in both areas. Equivalent coverage may be available using a single radio site to cover both areas.

Trunked radio sites with only two frequencies have a very high likelihood to produce busy signals. Capacity on these radio sites could appear worse than experienced with the present conventional systems because radio users will receive a busy tone when a PTT is pressed. The control channel will permanently occupy one of the available channels, leaving only one operational channel. L.R. Kimball recommends that Medina County acquire additional VHF frequencies for these locations, or implement a trunking solution that permits voice operation on the control channel if no other channels are available. It does not appear that existing conventional channels are licensed in the trunking mode. Existing channels may be re-allocated to trunking licenses if the distance to co-channel and adjacent-channel users is sufficient.

System migration will likely be required prior to the 2013 narrowbanding deadline. Subscriber estimates are assumed to total 250 for all county emergency responders. System details are assumed, and will be updated by L.R. Kimball upon further receipt of information.

To establish regional interoperability, L.R. Kimball recommends that Medina County implement an 800 MHz NPSPAC interoperability repeater on the 8CALL90 channel and tie three control stations to the 700 MHz LCRA system once the system has been expanded within Medina County.

The following table summarizes the channels as they will appear in the system:

Table 311 – Medina County System Channels

Channel	Description
Channel 1	Medina SO Dispatch
Channel 2	Medina SO TAC
Channel 3	Castroville PD Dispatch
Channel 4	Castroville PD TAC
Channel 5	Devine PD Dispatch
Channel 6	Devine PD TAC
Channel 7	Hondo PD Dispatch
Channel 8	Hondo PD TAC
Channel 9	Fire Dispatch
Channel 10	Hondo VFD
Channel 11	Natalia VFD
Channel 12	Devine VFD
Channel 13	Castroville VFD
Channel 14	D'Hanis VFD

The following table summarizes details regarding the recommended system for Medina County:

Table 312 – Medina County Radio System Details

Channel	Description
Number of Radio Sites in System:	5
Number of Channels in System:	15
Frequency Band:	VHF
Trunking or Conventional:	Trunking
Simulcast (Yes or No)	No
Technology (NB analog, P25, etc)	P25
Coverage Requirement	90% Portable (recommended)
Number of Console Positions:	5 (assumed)
Number of subscriber units on system:	250 (assumed)
System Reliability	99.999%
Encryption	TBD
Telephone Interconnect	TBD
Private Call	Supported

Channel	Description
Growth Flexibility	Frequency availability dependent
Automatic Vehicle Location	No
Emergency Features	Emergency Alert
Specialized Equipment	Mobile Gateway
Equipment Standardization	P25 Phase I Trunking
Channel Scan	Yes
Unit ID	Yes
Improved Audio Quality	Digital audio quality
New Equipment	New subscriber radios, consoles, and fixed infrastructure
Paging and Alert Systems	Maintained on analog

7.4.11.2 Cost Estimate

The cost estimate is based on averages for list prices of the typical components of a system with this design. Specific designs will vary in price. Cost savings may be recognized by reusing existing equipment. This determination will ultimately be made by the selected vendor.

Table 313 – Medina County Cost Estimates

Component	Cost per Unit	Quantity	Cost
Radio Sites	\$450,000	5	\$2,250,000
Dispatch Consoles	\$60,000	5	\$300,000
Subscriber Radios	\$3,500	250	\$875,000
800 MHz Repeater	\$30,000	1	\$30,000
700 MHz Connectivity	\$10,000	3	\$30,000
Total			\$3,485,000
Maintenance Fees	\$64,500 / year		\$64,500 / year
Ongoing costs			\$64,500 / year

7.4.11.3 Migration Plan

There are several key milestones that must be considered for migration to a countywide P25 VHF system. These include:

January 1, 2013—It is assumed that Medina County is currently operating numerous analog radios that will not meet the FCC's narrowbanding requirement. Wideband equipment must be replaced and operating in a narrowband mode prior to 2013.

End of 2015—The end of 2015 has been targeted as a statewide goal for P25 operation.

2011

L.R. Kimball recommends that Medina County pursue a contract with an equipment vendor during 2011. Medina County may pursue a sole source contract with an equipment vendor of choice or pursue a competitive procurement. In general, L.R. Kimball recommends a competitive procurement process to reduce overall system costs. Because Medina County will require numerous subscriber replacements, L.R. Kimball recommends that Medina County pursue subscriber radios in conjunction with fixed infrastructure to achieve additional vendor bundle discounts.

L.R. Kimball recommends that Medina County target mid-2011 for a signed vendor contract. During the fourth quarter of 2011, L.R. Kimball recommends that Medina County and the selected equipment vendor decide on a system design and order equipment for the system. L.R. Kimball recommends that Medina County pursue a design that provides 90 percent portable coverage countywide.

Total system costs have been split between 2011 and 2012.

Estimated Cost: \$1,742,500

2012

L.R. Kimball recommends that Medina County implement the system during 2011. At the beginning of 2012, Medina County may deploy P25 subscriber radios. Subscriber radios should be programmed for both the trunking system talk groups and existing system conventional channels. User training will be necessary to accustom radio users to the new radios and operational changes with using a trunking system. Equipment staging is recommended to permit the construction and testing of the system in a controlled environment. Following the completion of equipment staging, equipment may be deployed in the field. L.R. Kimball recommends that testing of the system be completed prior to system cutover. Testing should include coverage testing to verify that the system meets operational requirements. Once the system is deemed operational, users may switch channels in select groups to access the new system. Frequencies on the old and new systems are different, which will permit for a simple migration. Once all users have cut over to the new system, L.R. Kimball recommends that the old systems be maintained for a period of one month to permit operations in the event of problems with the trunking system. After the evaluation period is complete, L.R. Kimball recommends that select analog stations be maintained for paging and/or fire station alerting operations. Other VHF stations may be decommissioned and their frequencies added to the existing radio sites where applicable.

L.R. Kimball recommends that operations maintain on TXLAW2, which will likely be reprogrammed to the VCALL frequency once a revised channel plan has been decided upon. L.R. Kimball recommends that Medina County include the 800 MHz interoperability repeater as part of the system installation for discount purposes.

Estimated Cost: \$1,742,500

2013 – 2014

L.R. Kimball recommends no action during 2013 and 2014.

2015

L.R. Kimball recommends that Medina County interface with the regional LCRA 700 MHz system once it is expanded to Medina County. The interface will include three control stations integrated on the Medina County consoles to permit a maximum of three patched channels. Two designated interoperability talk groups will be established on the regional P25 system to permit interoperability specifically within Medina County. The system will permit 700/800 MHz users to provide mutual aid within Medina County.

Estimated Cost: \$30,000 (three control station interfaces at \$10,000 per station)

Ongoing Costs

Following trunking system implementation, L.R. Kimball estimates that ongoing system maintenance costs in the amount of \$64,500 per year will be incurred.

Estimated Cost: \$64,500 / year

Cost Breakdown by Year

The following table breaks down the system cost on a year-by-year basis.

Table 314 – Medina County Cost Breakdown by Year

Year	Amount	Description
2011	\$1,742,500	Half of system implementation costs
2012	\$1,742,500	Half of system implementation costs
2013	0	
2014	\$64,500	Maintenance fees
2015	\$94,500	Maintenance fees and 700 MHz connectivity
2016	\$64,500	Maintenance fees
2017	\$64,500	Maintenance fees
2018	\$64,500	Maintenance fees
2019	\$64,500	Maintenance fees
2020	\$64,500	Maintenance fees
Total Cost 2011-2020	\$3,966,500	

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7.4.11.4 Funding Gap

The following table summarizes the estimated funding gap based upon past and present future funding sources identified by Medina County.

Table 315 – Medina County Funding Gap

	Amount
Past Expenditures (2006 – 2010)	--
Future Funding (2011 – 2020)	--
Estimated Costs (2011 – 2020)	\$3,966,500
Total Funding Gap 2011 – 2020	\$3,966,500

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7.4.12 Wilson County

As indicated in the baseline systems assessment, there are several underlying operability and interoperability gaps present within Wilson County today. To summarize these gaps, the following list has been provided.

Coverage—Portable coverage levels were reported in the 70 to 75 percent range, which is far below the recommended coverage level. Coverage is a regular problem for radio system users.

Capacity—Law enforcement and fire/EMS are limited to one channel at each of the transmitter locations.

7.4.12.1 Recommended System

L.R. Kimball believes there are two potential options for Wilson County: upgrade to a P25 conventional simulcast system in the VHF band or upgrade to the LCRA 700 MHz P25 trunking system. Both solutions would require all emergency responders within Wilson County to migrate to a shared countywide digital P25 platform. Because it will likely be 2015 by the time the regional system is expanded into Wilson County, L.R. Kimball favors implementation of a VHF system, and migration to the 700 MHz system in the long-term.

L.R. Kimball recognizes that Wilson County has spent a considerable amount of funding on VHF P25 conventional infrastructure. Limitations within the VHF band are associated with frequency acquisition. Wilson County currently utilizes two VHF repeater pairs. An ideal countywide infrastructure would utilize trunking technology; however, a substantial number of VHF repeater pairs would be necessary; it is not likely that sufficient VHF spectrum would be available. In addition, many of the Kenwood P25 radios utilized within Wilson County are not capable of trunking operation and would need to be replaced. The most realistic VHF system for Wilson County is a VHF P25 conventional simulcast system. Such a system would require the addition of tower sites to provide countywide coverage for a total of three radio sites. An additional 2 to 3 channels would be necessary for a conventional simulcast system, compared to 10 to 15 channels that would be necessary for a trunking system. Any VHF solution will require a fixed infrastructure solution by Wilson County.

The conventional simulcast system will operate in a similar fashion to the existing system, using voted satellite receivers. Each user group will operate on their own distinct frequencies. With a simulcast solution, the same frequency is transmitted from multiple radio sites. An equipment vendor would be contracted to design the radio system to meet specified coverage requirements. For Wilson County, L.R. Kimball recommends a 90 percent outdoor portable coverage requirement. The system will permit countywide roaming by radio users without having to switch channels to access different repeater sites. L.R. Kimball recommends that the two present repeater frequencies be implemented in a simulcast configuration, and that two additional VHF frequency pairs be identified for operation in the simulcast system. Once operational, the system will provide countywide coverage on four repeater pairs.

To alleviate interoperability gaps present within Wilson County, L.R. Kimball recommends that Wilson County implement interoperability base stations programmed on the VHF and 800 MHz calling channels to permit a minimum level of VHF and 800 MHz connectivity to all potential incoming interoperability users. The base stations would be tied to the existing dispatch consoles, which would then permit patching the traffic to the primary operational channels. To interconnect with systems co-located within Wilson County, such as DPS, TXDOT, and the ISDs, L.R. Kimball recommends that Wilson County implement control stations at the dispatch center tied to channels on

the systems, and tie the control stations into the dispatch console. This will permit Wilson County dispatchers to monitor traffic on these systems and patch traffic to the Wilson County primary system.

Should a VHF system be implemented, L.R. Kimball recommends that Wilson County integrate the system with the regional LCRA 700 MHz system once it has been constructed in Wilson County. L.R. Kimball recommends that Wilson County tie three control stations to the regional system to permit a total of three operational talk groups on the regional system that can be patched to the Wilson County primary system. The connectivity will permit 700/800 MHz users to operate on the system to support a mutual aid event within Wilson County. Dispatchers will be able to patch the talk groups to primary VHF channels. Should Wilson County migrate to the regional system, interoperability will be achieved on the regional system through the use of shared talk groups and patched connectivity will not be necessary.

Even if Wilson County pursues the VHF option, L.R. Kimball recommends that Wilson County explore the opportunity of migrating to the regional 700 MHz system once the system has been implemented within Wilson County. The system would need to provide adequate coverage in order for the system to be an option.

The following table summarizes the channels as they would appear in a VHF conventional simulcast system:

Table 316 – Wilson County VHF System Channels

Channel	Description
Channel 1	Law Enforcement Dispatch
Channel 2	Law Enforcement TAC
Channel 3	Fire/EMS Dispatch
Channel 4	EMS TAC

The following table summarizes details regarding a VHF conventional simulcast system for Wilson County:

Table 317– Wilson County VHF Conventional Simulcast Radio System Details

Channel	Description
Number of Radio Sites in System:	3
Number of Channels in System:	4
Frequency Band:	VHF
Trunking or Conventional:	Conventional
Simulcast (Yes or No)	Yes
Technology (NB analog, P25, etc)	P25 Phase I conventional
Coverage Requirement	90% portable (recommended)
Number of Console Positions:	3
Number of subscriber units on system:	Approximately 340
System Reliability	99.999%

Channel	Description
Encryption	Supported
Telephone Interconnect	No
Private Call	No
Growth Flexibility	Dependent on frequency availability
Automatic Vehicle Location	No
Emergency Features	Emergency alert
Specialized Equipment	Mobile gateway
Equipment Standardization	P25 Phase I conventional
Channel Scan	Yes
Unit ID	Yes
Improved Audio Quality	Digital audio quality
New Equipment	Replacement of analog subscriber radios
Paging and Alert Systems	Maintained in analog mode

7.4.12.2 Cost Estimate

The cost estimate is based on averages for list prices of the typical components of a system with this design. Specific designs will vary in price. Cost savings may be recognized by reusing existing equipment. This determination will ultimately be made by the selected vendor.

The following are the estimated costs for migration to the VHF conventional simulcast system with a long-term 700 MHz migration:

Table 318 – Wilson County VHF Cost Estimates

Component	Cost per Unit	Quantity	Cost
Radio site	\$300,000	3	\$900,000
Consoles	\$60,000	1	\$60,000
Subscriber equipment	\$2,000	200	\$400,000
VHF interoperability base station	\$30,000	1	\$30,000
800 MHz interoperability repeater	\$30,000	1	\$30,000
700 MHz control stations	\$10,000	3	\$30,000
Licensing fees	\$10,000	1	\$10,000
700 MHz Migration	\$3,500	340	\$1,190,000
Total			\$2,650,000

7.4.12.3 Migration Plan

There are several key milestones that must be considered for migration to one of the two systems. These include:

January 1, 2013—Wilson County operates numerous radios that will not meet the narrowbanding deadline and must be fully operational on the system by January 1, 2013.

End of 2015—The end of 2015 has been targeted as the completion date for statewide P25 systems.

2011

Because wideband radios must be replaced prior to the end of 2012, immediate action is necessary to begin replacing wideband radios. The replacement radios will depend on the system Wilson County selects.

If Wilson County plans to implement a VHF conventional simulcast system, L.R. Kimball recommends that Wilson County explore VHF licensing opportunities to acquire two additional VHF conventional channels. Conventional stations have the capability to be implemented using unique NACs to filter out interfering signals. This makes licensing conventional channels easier than licensing trunking channels. Obtaining two additional VHF frequency pairs for countywide conventional operation should be possible for Wilson County.

L.R. Kimball recommends that Wilson County negotiate subscriber replacements with the selected equipment vendor.

L.R. Kimball recognizes that funding may not be immediately available for either option in the short-term. However, subscriber replacements are necessary for about half of the existing radio fleet to meet the narrowbanding deadline. This equates to approximately 150 subscriber radios.

L.R. Kimball recommends that Wilson County pursue a contract with an equipment vendor during the second half of 2011. Wilson County may work with an equipment vendor of choice; however, cost savings may be recognized through a competitive bid process. Radio site development will need to take place during 2011 to prepare for equipment installation during 2012. System installation may be extended permitting that subscriber radios are replaced prior to the 2013 deadline.

Cost estimates reflect approximately half of the system costs for the conventional simulcast system and replacement of one half of the analog subscriber radios.

Estimated Cost: \$715,000

2012

L.R. Kimball recommends that system staging, installation, testing, and acceptance take place during 2012. Equipment staging will include the assembly of system infrastructure in a controlled environment to permit proof of performance before the system is installed. Upon approved testing of the staged equipment, equipment may be deployed in the field. Replacement subscriber radios will need to be deployed during 2012. Replacement radios may be deployed immediately as radios will be capable of operating on the current and new system. L.R. Kimball recommends that coverage testing be performed on one of the two new frequencies to verify operational

performance prior to system cutover. Upon successful completion of coverage testing, L.R. Kimball recommends that the systems be implemented in parallel, with equipment for both systems existing concurrently. Cutover would require the two new frequencies be implemented first. Users would switch operation to the new frequencies. Once system performance is verified, the two original Wilson County frequencies could be cut over to the new system. System operation on the new system would be nearly identical to operations on the present system, but with enhanced coverage and channel capacity.

L.R. Kimball recommends that Wilson County install the VHF and 800 MHz base stations and implement an additional dispatch console position.

Estimated Cost for VHF Option: \$715,000

2013 – 2015

If the VHF option is selected, the coming years may be used to continue the replacement of narrowband analog subscribers, if any remain. All migration costs for this option have been reflected during 2011 and 2012.

L.R. Kimball recommends that Wilson County establish connectivity with the regional 700 MHz system once it has been built out within Wilson County. L.R. Kimball recommends that a total of three control stations be tied into the regional system with patching capability to the primary operation channels.

Estimated costs reflect the installation of three 700 MHz control stations.

Estimated Cost: \$30,000

2016 – 2020

L.R. Kimball recommends that Wilson County evaluate migration to the 700 MHz regional system in the longer term. The system will provide flexible growth and increased capacity to the VHF system as well as the ability to roam throughout the AACOG region and the interconnected network of 700/800 MHz systems. L.R. Kimball only recommends a potential 700 MHz migration once VHF equipment in use has reached end-of-life.

Estimated costs for the migration are associated with the replacement of approximately 340 subscriber radios.

Estimated Cost: \$1,190,000

Ongoing Costs

Estimated ongoing costs for the VHF system include system maintenance, leased line costs, and tower leases.

Estimated ongoing cost for VHF option: \$25,500 per year

Cost Breakdown by Year

The following table breaks down the system cost on a year-by-year basis.

Table 319 – Wilson County Cost Breakdown by Year

Year	Amount	Description
2011	\$715,000	Half of VHF system costs
2012	\$715,000	Half of VHF system costs
2013	\$30,000	700 MHz Connectivity
2014	\$25,500	Maintenance costs
2015	\$25,500	Maintenance costs
2016	\$25,500	Maintenance costs
2017	\$25,500	Maintenance costs
2018	\$25,500	Maintenance costs
2019	\$25,500	Maintenance costs
2020	\$1,190,000	700 MHz Migration
Total Cost 2011-2020	\$2,803,000	

7.4.12.4 Funding Gap

The following table summarizes the estimated funding gap based upon past and present future funding sources identified by Wilson County:

Table 320 – Wilson County Funding Gap

	Amount
Past Expenditures (2006 – 2010)	\$143,200
Future Funding (2011 – 2020)	--
Estimated Costs (2011 – 2020)	\$2,803,000
Total Funding Gap 2011 – 2020	\$2,803,000